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Prices Look Good,
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The Photographs?



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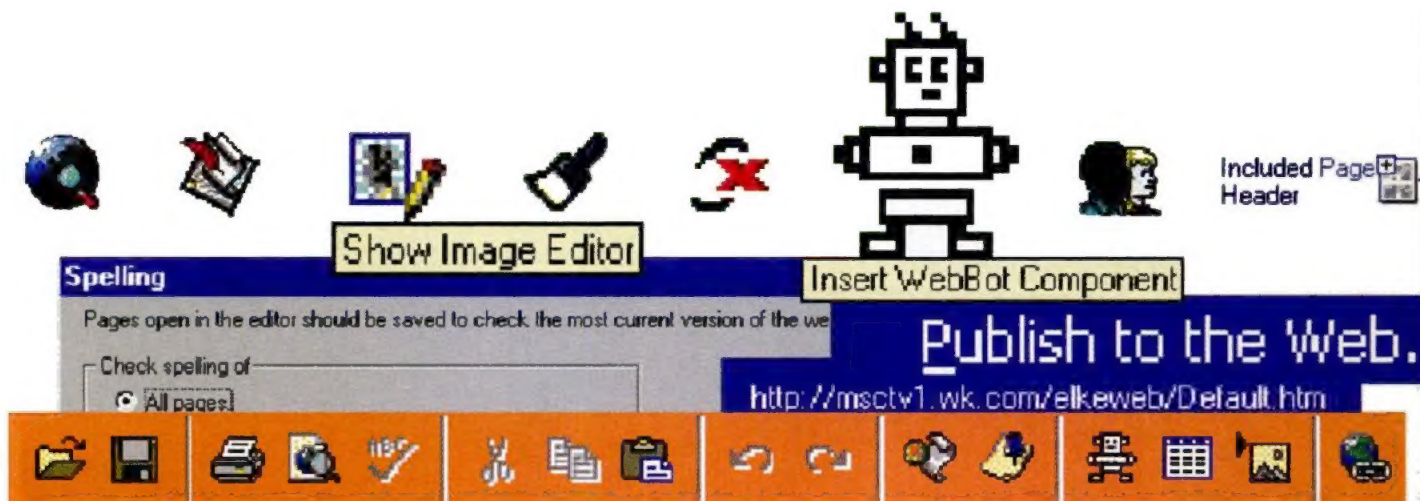
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PICTURE ON AN NEC MULTISYNC
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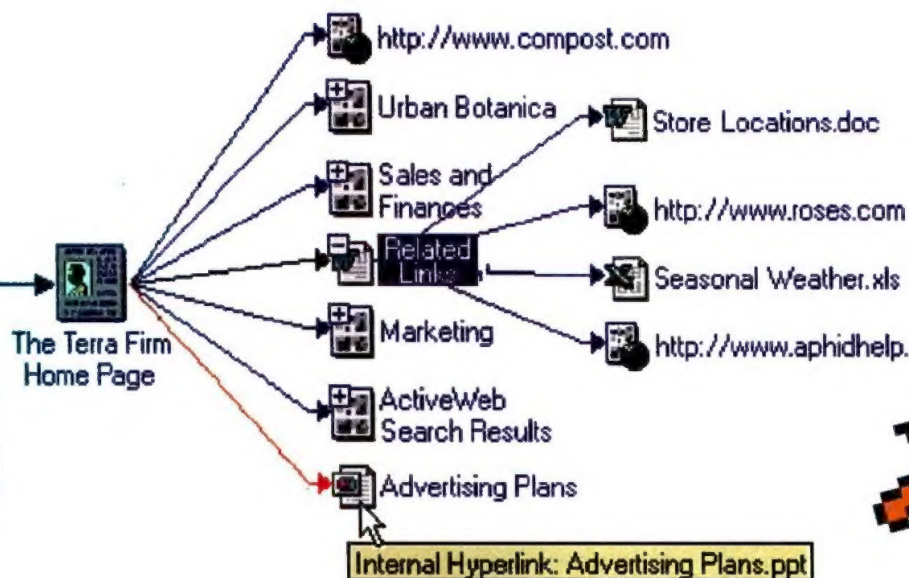
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Unfinished Business



When I look back on the products introduced in 1996, it's amazing to see how far we've come. Just take a look at the products we named the Best of the Year (beginning on page 100). In 1996, we witnessed two new generations of browsers, each with more powerful features than anything we had previously seen. We saw an

incredible number of new sites and new services on the Internet, new servers to host these sites, and new utilities to help those who produce them as well as those who use them.

And though the Internet deservedly got the most attention, we also saw improvements in other areas. Of course, we saw faster and faster PCs at better prices. Perhaps a more unusual development was the evolution of a new breed of home PCs with built-in audio, telephone, and TV features. And we saw tremendous advances in network infrastructure technologies.

But the one thing on which we can all agree is that there's still plenty of room for improvement. For instance, the computers we use at our offices are still too hard to manage. Installing new hardware too often results in interrupt conflicts, driver incompatibilities, and other unforeseen difficulties. Even if you don't buy all those cost-of-ownership studies (and I don't), it's not hard to understand why the cost of installing, maintaining, and upgrading systems is far greater than the cost of the hardware itself.

Business machines should be able to report back to a central server with information on their configurations, peripherals, and other details. They should have built-in identification numbers so they can be tracked by a central server, and administrators should be able to update client PCs from such a server.

The computers we use at home have come a long way from the era when a "home PC" was just a business computer with an encyclopedia and a game or two thrown in. But home PCs are still too complicated. Too often, plug-and-play is more like plug-and-pray. There's no reason why consumers should have to worry about running out of IRQs.

On the software side, just as much work needs to be done. The Windows 95 user interface is a step in the right direction, but there's plenty of room for improvement. Why should new releases of Internet Explorer have to upgrade your operating system silently? Why should upgrading from Windows 95 to Windows NT require you to re-install most of your applications? Why should the Registry

be so ridiculously complicated to use? And why do we need to worry about a Registry in the first place?

Granted, Windows is far from perfect. But many of the alternatives are looking even worse. OS/2 spent most of the year without a decent browser, and Apple still hasn't been able to get a multitasking, multithreaded OS out the door. Java offers the best hope for a real cross-platform alternative, but it's hard to be convinced when I keep running into applets that don't work correctly with different browsers on the same machine.

Without question, browsers have gotten more powerful. I'm looking forward to seeing better integration with e-mail and operating systems over the next few months. But why should browsers crash so often when confronted with a difficult page? Why do the same bugs linger in version after version? We need new features and more stability.

Development tools like OLE and Visual Basic have improved connectivity among applications, and more tools, such as Live Objects and JavaBeans, are on the horizon. But why, after all these years, is it still so hard to link applications together? For years, I've been looking for a good multiuser system that can link together my word processor and desktop publisher with decent workflow features. I'm still waiting.

In short, we should ask a lot more of computer hardware, software, and networking vendors. We've come a long way in 1996, but I'm not satisfied, and you shouldn't be, either.

Michael J. Miller
MICHAEL J. MILLER

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ONLINE



What's New Online

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Join us at www.pcmag.com for an interactive

look at the best products of 1996, as well as additional coverage to accompany the Java tools stories in this issue. Also on the Web: weekly commentary from John C. Dvorak, Michael J. Miller, and Don Willmott.

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BY JAKE KIRCHNER

We're back again with our favorite products for another year. No qualifications or restrictions here! Some of these 50 favorites were Editors' Choices in the past year, but many just simply impressed us. We finish out with Don Willmott's year-end "Abort, Retry, Fail?" and "Jim Seymour's Thumbs Up, Thumbs Down of 1996".....100

FEATURES

DIGITAL CAMERAS

Heave-Ho, Silver!



BY DANIEL GROTTA AND SALLY WIENER GROTTA
It might be time. Prices are way down for digital cameras, which should increase their popularity. They still can't match the quality of 35-mm film, but they'll do just fine in many situations—especially with images destined for

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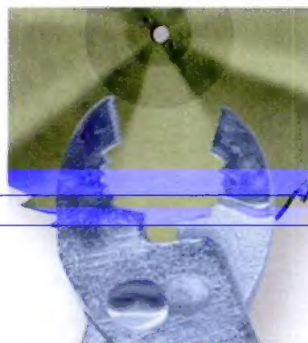
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PROGRAMMING

Java Tools Get Real

BY RICHARD V. DRAGAN
It's not just a cool name anymore. Java programmers, anxious to deliver ever more exciting Java apps, now have better

tools. We review three second-generation development systems here, but lots more are on the way. And we get our first look at JavaBeans.....181



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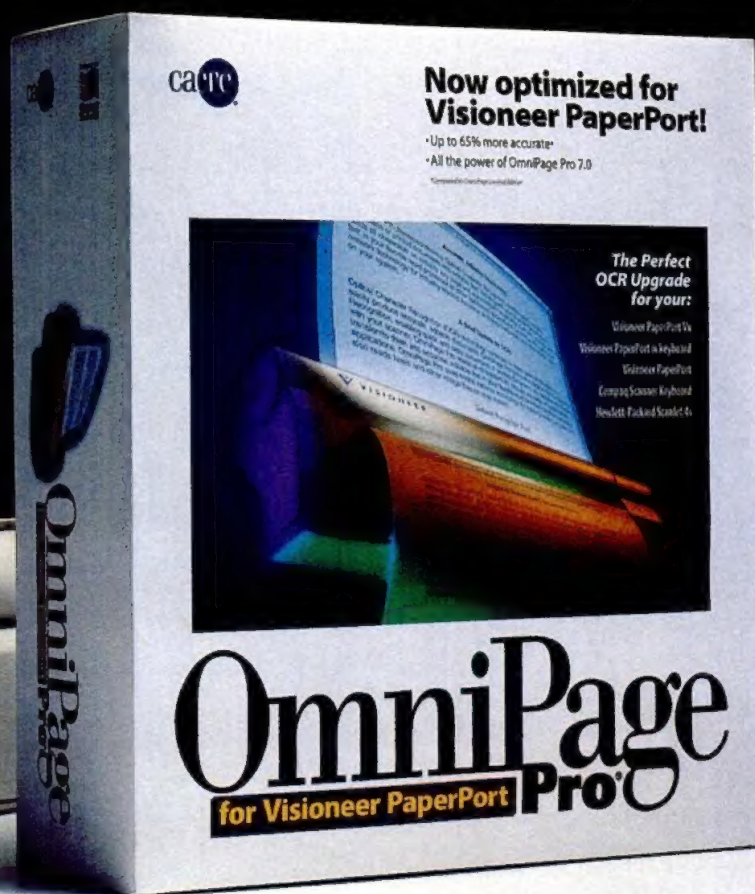
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Pipeline

NCs Move Beyond Hype



San Francisco's recent Oracle Open World conference turned out to be more of a showcase for hardware than for software. On the heels of Sun Microsystems' debut of its JavaStation network computer and of Microsoft's NetPC initiative with Intel, a number of hardware partners that are backing a reference design from Oracle subsidiary Network Computer Inc. (NCI) showed their own low-cost, "zero administration" network computers. The demonstrations ranged from currently available products to next-generation network computers.

Future models shown included a network computer television, set-top boxes, and executive telephones with browsers. RCA announced that it will deliver a \$300 set-top-box network computer in 1997 for the consumer market, and Proton Industrial Electronics announced plans for a similarly positioned \$499 set-top box.

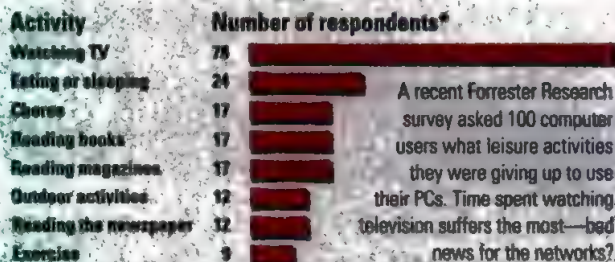
Unexpected variations on NCI's reference design included the announcement of a

wireless \$500 network computer from Uniden (due in early 1997) and a demonstration by NCI of a network computer designed for streaming video. Contrary to analyst predictions that NCs would not arrive until 1997, companies such as Acorn Computer, Akai, and Funiden showcased real products toward the end of 1996.

Software companies, including Com.Sortium, The Consumer's Choice Network, IntelliMatch, and NetChannel, also demonstrated network computer applications.

Oracle CEO Larry Ellison recently positioned the network computer as a solution for those who don't necessarily want Microsoft Windows and Windows applications. Microsoft and Intel are challenging that notion head-on with the announcement of a slew of hardware partners supporting the NetPC initiative. These partners have pledged to develop low-cost, low administration Windows machines that have local storage—something Oracle's NCs lack.

Not Now, Honey, I'm on the PC



* Multiple responses were accepted.

Source: Forrester Research.

A recent Forrester Research survey asked 100 computer users what leisure activities they were giving up to use their PCs. Time spent watching television suffers the most—bad news for the networks?

"Java has done something no other technology innovation has been able to do: unite an entire industry—with one exception—around a single standard."

IBM Internet division general manager **Irving Wladawsky-Berger** at the launch of IBM's "e-commerce" strategy.



Read Ads for Real Money

How would you like to get paid to read advertisements on the Web? At CyberGold (www.cybergold.com), you draw up a detailed profile of yourself, then receive a collection of interactive ads. If you fit the demographic profile for which an advertiser is looking, you'll get between 50 cents and \$2 to read each ad. You can elect to receive a check (when your earnings

reach \$20, or a \$20 increment), donate the money to charity, or save it up to buy merchandise from the site.



The idea is to provide advertisers with a highly efficient way of getting guaranteed response to their ads. CyberGold says that it won't release the names and addresses of ad readers to advertisers unless an ad reader requests more information.

Battery Bonanza

Walk into a computer superstore to try to get a new battery for your notebook and in no time, you're likely to find yourself up a creek. The solution: 1-800-Batteries, a 24-hour clearinghouse that stocks 6,000 batteries for notebooks, cellular phones, and camcorders.

Check out the company's Web site (www.800battery.com) for a product list that includes an Apple PowerBook solar pack, and for advice on the care and feeding of your battery—including such highlights as how to "burp" it.



Online: Jumping into Java

Nothing is more important to the Web these days than Java, and that's why PC Magazine Online has prepared interactive looks at the latest Java tools in conjunction with this issue's feature story, "Java Tools Get Real." Find out what's new and join Java experts in conversations about this pivotal technology.

DIGITAL CAMERAS. Is it the end of film as we know it? Play with a good digital camera for a while and you may start to think so. Join us online and use our exclusive interactive summary of features to help figure out which digital camera is right for you. **ALSO ON THE WEB.** Don't miss our interactive look at the best new products of 1996, and be sure to check in with weekly commentators John C. Dvorak, Michael J. Miller, and Don Willmott. Feel free to talk back, too—our new, easier-to-use discussion forums will help you make your opinions known.

Pipeline

HyperSonic Arrays

The one weak link in reproducing perfect sound has always been the speakers. But now a San Diego-based electronics company believes it has found the answer: eliminate them altogether.

In a recent demonstration held at *PC Magazine*, Elwood Norris, the director of American Technology Corp., used a small array of transducers about the size of an Oreo cookie to play music and voice recordings. Dubbed HyperSonic Sound, the devices use tiny vibrating transducers (the same kind of components used in exploratory heart surgery) to generate ultrasonic waves and excite the molecules in the air. When the amplitudes of two ultrason-

ic waves—which vibrate beyond the range of human hearing—are combined, they create a third, audible waveform. Similar techniques have been tried before, but Norris's invention appears to be the first successful device for playing music.

The size of these panels and their method of sound reproduction means they could be placed nearly anywhere, even on the front of your computer monitor, without diminishing or affecting the quality of the sound.

Since the sound is highly directional, the device is like a sonic flashlight. Aim it at a wall or a person and the sound seems

to come directly from that point. HyperSonic arrays installed in movie theaters, for instance, could create the illusion that a getaway car is speeding around the theater.



Portrait of an Online Achiever

Pacific Bell estimates that 25 percent of the heads of online households fit this profile of an "Online Achiever," the target customer for ISDN services. In California, PacBell recently launched Home Pack, a service that promises to take the guesswork and frustration out of ISDN installation by simplifying the process to a single phone call (800-472-4736).



THIS ISSUE'S CONTRIBUTORS: Regina Kwon, Carol Levin, John R. Quain, and Sebastian Rupley.

Online Security Blanket

Managing your 401(k) account or filing benefit claims on your corporate intranet requires a leap of faith on your part that the information will remain private and secure. Chrysalis, based in Ottawa, Ontario, Canada, has come up with an approach it claims provides a higher level of security than software alone does.

The company has combined two elements of electronic security—encryption (which ensures privacy) and digital signatures

(which verify the identities of parties in a transaction)—into the Luna card, a PC Card you can take with you to use in your notebook, your desktop at work, or your home computer. The Luna card stores its encryption algorithms and private keys in its own programmable read-only memory and performs all encryption functions inside its cryptographic processor—not on your PC. Chrysalis plans to target intranet applications first, followed by Internet applications.

Talking Web Pages

As marriages between telephones and the Web proliferate with such products as cellular phones with built-in browsers, a new twist is taking shape: text-to-speech translation of Web pages over ordinary phones. NetPhonic, a Mountain View, California-based company, is targeting its Web-On-Call text-to-speech technology at corporate users who want to stay tethered to the Web without a PC or cellular phone/browser combo.

According to NetPhonic president Ken Rhie, "Makers of network computers, browser-based phones, and other appliances all want Web users to buy some proprietary hardware, while all we're requiring is a basic telephone."

NetPhonic's Web-On-Call software uses Touch-tone signals from any telephone to jump from link to link within a Web page. The software can either translate Web text into speech or transmit a page to a fax machine. You must first design the Web pages for Web-On-Call's text-to-speech synthesis by creating templates of prerecorded audio for the portions of pages that don't change.

In the short run, according to Rhie, sales automation over intranets is the primary application for Web-On-Call. Eventually, the software will incorporate speech recognition.



Top Retail PC Games

1. **Warcraft II: Tides of Darkness** Blizzard Entertainment
2. **MechWarrior 2** Activision
3. **Duke Nukem 3D** 3D Realms
4. **Elder Scrolls 2: Daggerfall** Bethesda
5. **Civilization II** MicroProse
6. **Myst** Broderbund
7. **Madden NFL 97** Electronic Arts
8. **Deadlock** Accolade
9. **Command & Conquer** Virgin Interactive Entertainment
10. **Links LS/Arnold Palmer** Access

Source: PC Data. Data for September 1996.



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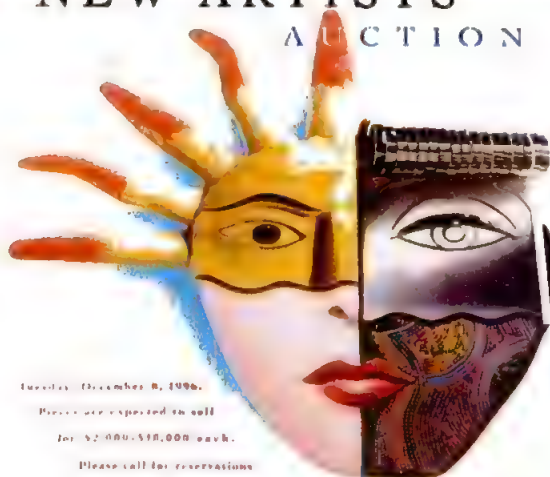
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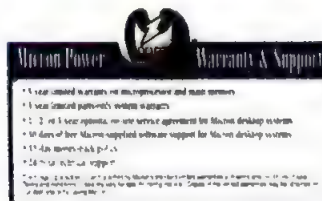
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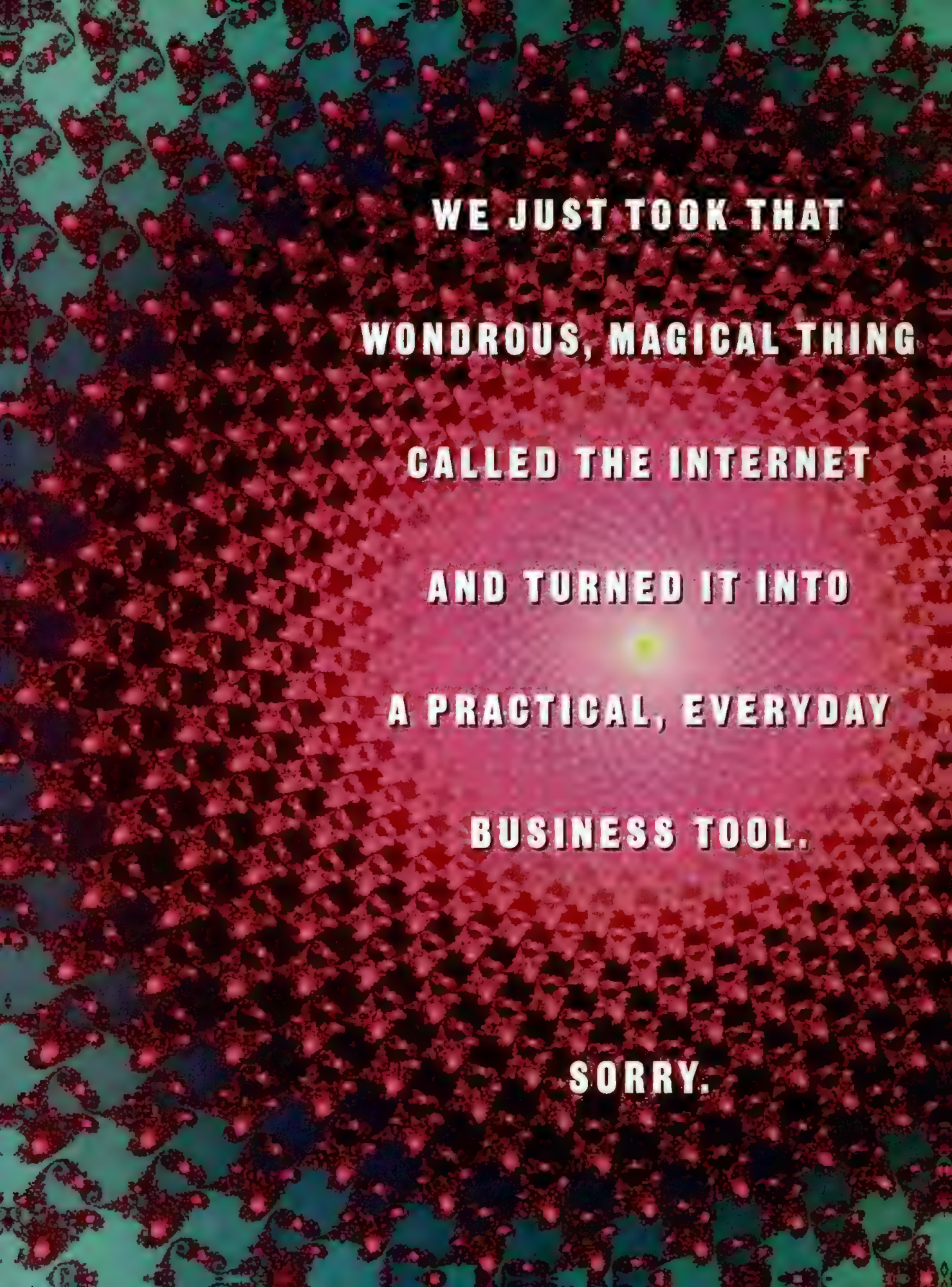
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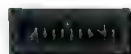
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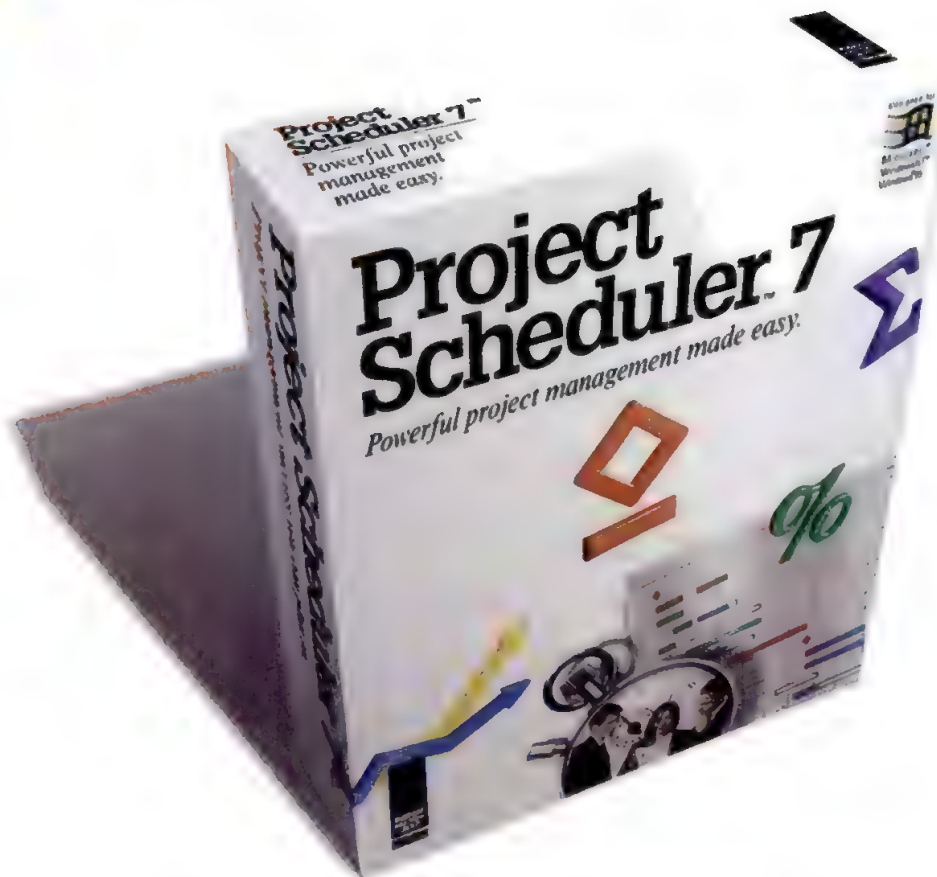
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Letters

TAKING SIDES

I'd like to comment on the cover article in your issue of October 22, "Browsers at the Crossroads." I was very impressed by the extensive tests done using both browsers and the ratings for various features. However, I felt that Netscape Navigator 3.0 was chosen as Editors' Choice for only one reason—its compatibility with more pages on the Internet than Microsoft Internet Explorer 3.0—even though technically, Internet Explorer is a better browser with more features. I don't understand this logic. Based on its feature set and pricing, I don't see how Internet Explorer can be beat.

JASON ANDERSON
via the Internet

My decision to use Netscape Navigator was made hands-on when, after spending an hour and a half downloading Internet Explorer 3.0, I spent another 2 hours attempting to install it. Even after three apparently successful installations, the program refused to operate, spewing forth never-ending errors that ultimately resulted in Windows 95 shutting it down. On the other hand, after spending an hour downloading Netscape Gold and 15 minutes installing it, I have been successfully using all of its features since then. Now it's easy to see why you stated, "Netscape Navigator remains the overwhelming market leader..."

J.C. BAILEY
via the Internet

Another difference between Netscape Navigator and Microsoft Internet Explorer that few people seem to notice is the support for client-side image maps. Internet Explorer's implementation includes support for map coordinates stored in a separate file, while Netscape reads client-side coordinates only if they are in the same file that links to the image.

JIM ZWICK
via the Internet

I loved your coverage of the battle between Navigator 3.0 and Internet Explorer 3.0. It was a good, nonbiased report that I couldn't have found anywhere else.

NIKHIL BHAT
via the Internet

LEFT OUT

I was disappointed in your treatment of end-user features of Netscape Navigator and Microsoft Internet Explorer. The reviews completely omitted any discussion of accessibility for people with disabilities. Navigator does not support the use of the Tab key to jump between hypertext links on a Web page, while Internet Explorer does. This single fact makes Navigator completely useless to the



Another difference between Navigator 3.0 and Internet Explorer 3.0 is....

hundreds of thousands of people who, for one reason or another, cannot use a mouse.

F. MARK SCHIAVONE
Gerrardstown, West Virginia

You left out one very important criterion for rating a browser: reliability. I used Navigator 3.0 for about three weeks until I could no longer put up with the frequent crashes and fatal errors. I then went exclusively to Internet Explorer 3.0. For anyone who would rather spend time online instead of restarting the browser, it's definitely the browser of choice.

DAVID DYSON
via the Internet

BLINDED BY SCIENCE

You dismiss the idea of testing across a live Internet connection because of the inherent lack of reproducibility. Although I find this concern justifiable, this is an ideal opportunity to use statistical experimental design, as is done routinely in the physical sciences. For example, you might test each browser at several randomly selected times over the course of a week, applying well-established methods to extract significant trends from the data. Many variables could be included, ranging from Web page content to the client operating system and hardware configuration.

JEFF COGEN
via the Internet

POSITIVE REINFORCEMENT

Regarding the Inside column of the October 22 issue: I highly commend your efforts in supporting the First Looks team. I love the

changes: expanding the opening review, extending the editorial deadlines, and tightening production. What took you so long?

ALEX C. POSADA
PC MagNet

USERS WHO KNOW

Jim Seymour's column "Windows NT Revisited" (October 22, 1996) preaches to the untrained and computer-illiterate about the lack of a good upgrade path to install Windows NT onto an existing PC. I think it's great that Windows NT has no upgrade path. I did technical support for Windows 95 and found that the best way to install it onto an existing system was a clean install to a new directory to avoid carrying over the configuration mistakes of the previous operating system. It's about time that the end users sit down with their PCs and understand what they're doing.

SEAN VANDEW
via the Internet

I believe that Seymour is overlooking key elements of Windows NT. Stability, reliability, and outright dependability are the reasons I migrated to Windows NT. With Windows NT 4.0, I have not found any incompatibilities. Whether Windows NT is slightly faster or slower isn't the point. My applications are mission-critical, and Windows NT is the operating system that provides the ultimate in reliability with compatibility.

BOB HARRIS
via the Internet

DVORAK'S DIFFERENT TRACK

It is refreshing to see that not everyone in the PC world considers the Amiga "a has-been game machine." In his October 22 Inside Track column, John C. Dvorak did an excellent job of summarizing why so many of us stick with our Amigas despite recent hard times. Thousands of Amigas are alive and well and still being used to produce video for the broadcast and nonbroadcast TV world, thanks primarily to true multitasking, tight operating system code, and excellent, cost-effective third-party hardware and software products.

SCOTT BATES
Quincy, Illinois

Let's give Dvorak a big round of applause. Everything he said is absolutely correct. It's refreshing that he's able to see the Amiga for what it really is. Functionally, the Amiga was doing things in 1985 that Microsoft only recently figured out. We Amigans were using terms like *multimedia* and *multitasking* when PC sound cards were still an expensive luxury.

BRIAN WITOWSKI
via the Internet



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Letters

This can't be the same Dvorak who's been dumping on the Amiga for as long as I can remember. The words *game machine* have been his favorite derogatory description for the Amiga—and now he's calling it "a decade ahead of its time"? Whoever the impostor is, keep him and lose the old Dvorak.

ORION HUBBARD
Portland, Oregon

I'm not a fanatic when it comes to the Amiga, but I do own one and know of its great multitasking, graphics, and sound capabilities. The same features allowed its detractors to kill it off as a game machine. Now I also own an IBM compatible because that's the machine to have if you're a computer gamer. This is what I find ironic: No one took the Amiga seriously because it made for a great game machine. Now that the PC has caught up with the Amiga in graphics and sound, row after row of PC games line the shelves of software stores.

BRIAN WITOWSKI
via the Internet

I WANT MY HDTV

John C. Dvorak's column of October 22, 1996, "The Digital-TV Disaster," which seems to suggest that the digital-TV standard was somehow kept from being widely known by government bureaucrats, is wrong. Various proposals have been widely available in Federal Communications Commission public notices. Further, participation in the standards-setting process was open, and representatives of the computer industry could have participated from the start. However, I think Dvorak is cor-

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In our After Hours review of Quake ("Quake: The Wait Is Over," October 8, 1996; page 455), we listed an incorrect phone number for id Software. The correct number is 800-434-2637.

Contrary to what was stated in the table for "Groupware: Reaching for the Net" (October 8, page 225), SuiteSpot does support rich text, graphics, and forms as well as clickable hypertext and URL links.

In our October 22 roundup of color printers (page 195), we listed the price for the Tektronix Phaser 480X incorrectly. The correct street price is \$13,500.

rect when he suggests that computer-industry participation in FCC rule-making proceedings was not as vibrant as it should have been. Participation has picked up of late, but much more is needed.

ALAN TILLES
via the Internet

When I read Dvorak's column on the proposed digital-television standard now before the FCC, I found four major misconceptions. First, Dvorak starts out by claiming that the Government "is on the verge of selling the public down the river to Japanese manufacturers—starting with Sony." The fact is that Japan effectively dropped out of the running several years ago when the FCC mandated a digital rather than analog system. Second, Dvorak says the standard "would consist of 18 different formats—all odd standards, resolutions, and frame rates." But that includes all the "standard-definition" modes. The high-definition formats, which are the ones of real interest, number only 6. Third, Dvorak seems incensed that the standard provides for interlaced monitor scanning at all and particularly that the highest-resolution format (1,920-by-1,080 pixels at 60 fps) is interlaced rather than progressively scanned. Finally, from the beginning, HDTV was envisioned as a wide-screen system, which increases the viewers' sense of involvement in a program. Dvorak complains that the 16:9 ratio "doesn't really match anything Hollywood is doing." In fact, 16:9 is a close fit to most modern movies. Clearly Dvorak has a narrow vision of the future of television as an extension of computing. But the proposed HDTV standard, which is quite flexible, can serve both.

MICHAEL RIGGS
New York, New York

ROSE-COLORED GLASSES

Concerning Bill Machrone's September 24 column, "A PDA for Musicians," I think he painted too rosy a picture of the Roland PMA-5. I bought it soon after it came out, and after using it intensively for a couple of weeks, I returned it mainly because I didn't like the screen: You can't look at the screen straight on and see it clearly. You have to tilt it—truly one of the most annoying design flaws I have ever seen. The user interface also needs work, and you can't upgrade the software. There are some

great features, including the trademark Roland sound, but the flaws put it squarely in the category of a first-generation product. I can't wait until someone gets it right.

ANDY KOGUT
via the Internet

ANOTHER ROAD

In the Solutions/Ask Our Advisor section of the September 24 issue, the response to Marc Kessler's letter, "Copy Protection in Windows 95," suggested writing down the Product ID key and storing it in a safe place. There is an easier solution. Take a fine-point permanent marker (such as a Sanford Sharpe) and write the Product ID on the CD-ROM. This way, wherever you have the CD-ROM, you also have the Product ID.

STEFAN KOWALEWSKI
via the Internet

CHAIN MAIL

In your September 24 Letters column, Frank Billington's letter objected to PC Magazine's reporting on prerelease Internet-access software. I agree. In the same edition, the New and Improved section reported that CompuServe had finally released CompuServe 3.0 and went on to describe some of its features. When I got that issue, the software was still not available, so I have a hard time believing that the final version was available to you when PC Magazine was sent to press.

B. CHRIS BREWSTER
San Diego, California

Although CompuServe has only recently begun to ship CompuServe 3.0, the company did provide us with final code before the September 24, 1996, issue went to press. For a full review of Version 3.0, see First Looks in the December 17 issue.—Ed.

I agree that America Online (AOL) has more than its share of fluff, but it's not as bad as Rick Gungel's letter makes it seem. True, many people are leaving AOL for Internet providers because of their increasing dissatisfaction with AOL's services, but there's still a lot that's good. I think the real problem is how commercial services may be reacting to the mass rush to the Internet. That's where AOL's real failure lies.

JAMES BROOKS
via the Internet

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INTRODUCING A CONCEPT PREVIOUSLY

OVERLOOKED IN MONITOR DESIGN.



While some monitor companies struggle to achieve a convergence of audio and video, one has patiently taken the time to engineer a truly integrated system: The media-ready series from Nokia.

The difference is obvious, yet



inconspicuous. Behind the sleek tooling, await dual powered stereo high/midrange speakers and a deep-tuned omnidirectional subwoofer ready to give color and space to the richest audio your computer can unleash. This builds on the expertise Nokia



applies to designing sound systems for German luxury cars, incorporating principles of near-proximity sound delivery. As Europe's premiere monitor company, Nokia has created a tuning port architecture housed in the monitor's swivel base which allows complete utility plus maximum aural impact. What's more, these systems build on Nokia's most award-winning monitor line: the X series. Now you can gaze into some of the most exquisitely ergonomic screens in the world—including the first to meet the new VESA standards for refresh and resolution. Their aperture grill of a mere .25 presented on a spacious 15.7" viewing area make these more than just screens. They are a work environment that is simultaneously soothing and exciting. The media-ready series are also the first systems to achieve TCO'95 standards for monitor emissions. With that, and the clutter of wires and speakers

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447X avc-17"	150Hz	140Hz	110Hz	100Hz	85Hz	72Hz
ALSO AVAILABLE IN 21-INCH						
445X av-21"	150Hz	150Hz	120Hz	110Hz	100Hz	80Hz
445X avc-21"	150Hz	150Hz	120Hz	110Hz	100Hz	80Hz

(21" actual viewing area is 19.69")



NOKIA



Trends



Way-Fast Phone Lines

Easy ISDN? Surely, you've got to be kidding.

It's hard to believe that anyone survives the experience of installing a home ISDN line. Many of the problems those courageous souls face arise from the fact that each ISDN installation requires a unique configuration based on many parameters. For example, choosing two 64-Kbps lines for one installation is entirely different from choosing one 128-Kbps line and one 64-Kbps line. Add to that the facts that many ISDN terminal adapters have not been compatible with routers, that ISDN is still not available in all cities, and that specifying all the right installation parameters has been tougher than keeping a car mechanic from fixing what isn't broken.

At Intel's summer strategy day in Silicon Valley, CEO Andy Grove declared ISDN "a huge disappointment," and said that he doesn't foresee its widespread success in the next several years.

A BETTER SUPPORT SYSTEM

Despite the pessimism, many computer hardware and software companies—including Intel—have realized that ISDN is potentially important enough to an increasingly online world that they can't just leave it to the phone companies. Motorola, 3Com, and U.S. Robotics are all offering free ISDN installation

assistance, up to and including walking phone-company employees through installations. And Hayes Microcomputer Products has an ISDN Solutions Center with specialists prepared to answer questions seven days a week.

Microsoft, too, has a program. Called Get ISDN for Microsoft Windows, the program features a Web page (www.microsoft.com/windows/getisdn) where you can put in an ISDN order, which Microsoft then sends—along with your installation parameters—to your local phone company. Major retailers such as CompUSA are also prominently displaying ISDN starter packs—the prices have dropped dramatically—that walk you through installation steps.

With the revenues ISDN promises in mind, regional phone companies are taking steps to make it easier and less expensive to get connected. Pacific Bell, which became an ISP last spring, recently launched its Home Pack, a simple, low-cost ISDN line/Internet access package that promises to eliminate all the guesswork and frustration of installation. According to Pacific Bell, today you've got 5 choices for ISDN phone-line configurations, 23 choices for terminal adapters, 4 choices for software, and 6 choices for ISP equipment. This tallies to a staggering 2,760 possible configurations. No thanks.

Pacific Bell promises that with a single phone call, you can order 128-Kbps ISDN service (monthly charges start at \$24.50; nights and weekends are free), buy a 3Com terminal adapter for as low as \$329, and get unlimited Internet access for a flat fee of \$49.95 per month. A support staff with special training in ISDN is available 24 hours a day, seven days a week. To test out the feel of an ISDN connection to the Internet, Pacific Bell has set up an ISDN simulator on its Web site (www.pacbell.com).

The driving force behind ISDN sales is Internet access, says Pacific Bell, which has installed approximately 100,000 ISDN lines in California. As the phone system becomes increasingly overloaded with computer connections to the Internet, Pacific Bell forecasts that it will install 100,000 new lines in 1997 and 1 million by the year 2000. After all, the phone network is designed to handle voice calls with durations of about 3 minutes, not data calls that take 30 minutes, explain Pacific Bell officials. "It's just a broken economic model."

Both computer industry players and phone companies stand to benefit from ISDN's growth, and their combined efforts may change the course of this problem-plagued high-bandwidth technology.—*Sebastian Rupley and Carol Levin*

The Pricing Picture

Pacific Bell recently launched its Home Pack, which offers ISDN-based Internet service at a flat monthly rate. The Microsoft Network has adopted a flat monthly rate as well for its ISDN-based Internet access



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unlimited use



\$89.95
50 hours



\$49.95
unlimited use



\$190.00
50 hours

Build Stores and They Will Come

Microsoft targets online storefronts.

Projections for electronic commerce are reaching the stratosphere, with analysts estimating that business-to-business transactions will be in the 100-billion-dollar-a-year range by the year 2000. With an eye on a piece of the pie, Microsoft recently unveiled Merchant Server, software that lets developers create Web "storefronts" that handle secure credit-card transactions.

Internet commerce has not taken off as predicted, because consumers are wary of putting credit-card numbers online, and because few compelling online shopping environments exist. In 1996, Microsoft acquired eShop's online shopping service, which, along with Merchant Server, says Microsoft's Paul Maritz, "will let commerce sites get running efficiently and present compelling, secure environments."

Merchant Server consists of a series of components that will compete with similar offerings from Netscape and Open Market. For example, both Microsoft and Netscape are focused on moving legacy order-processing systems

to the Web, which Merchant Server handles through its Order Processing API. Among Merchant Server's key components are a Promo Manager for creating promotions and an Activity Tracker for logging buyer activity. Like NeXT's Web Objects, Merchant Server generates custom Web pages. On a first visit, each shopper gets a custom ID that is stored within the browser's "cookie" log, so subsequent visits are customized to the buyer's tastes. Merchant Server is also scalable, so multiple stores can be served by one Merchant Server.

SHOP, SHOP, SHOP: Microsoft builds malls in cyberspace.

Several businesses have adopted Merchant Server, including 1-800-Flowers, CompUSA, and Tower Records. Microsoft is also working with financial institutions, including American Express, BankAmerica, and Wells Fargo, on secure electronic payments.

Merchant Server faces some roadblocks. For one thing, at \$14,995 (plus \$3,495 for an administration kit), it's not cheap. And though Merchant Server's transactions module is based on the SSL and SET security standards supported by MasterCard and Visa, convincing users that transactions are secure is yet another hurdle.—*Sebastian Rupley*



Java Tools Generate a Buzz

THE ONLY CONSTANT IS CHANGE, AND THAT'S certainly true for computer languages. Sun Microsystems' Java language is the newest agent of change. Sun wants Java, which is ideally suited for the Web, to dethrone C++ as the language of choice for business computing applications.

The chance to put Java to the test for this issue's feature story, "Java Tools Get Real," proved an irresistible opportunity for our editors and reviewers. Java tools vendors visited PC Magazine Labs during a two-week period in October. We prepared a test-bed of identically configured machines—including our own private intranet—met with each vendor to discuss the products, and followed up with two days of hands-on testing.

VISUAL PROGRAMMING

Our testing script stressed such traditional functions as user-interface design and connectivity and also focused on brand-new approaches to development. We quickly discovered that these new tools put the general user rather than the traditional developer first. This meant more visual programming, not writing source code by hand, as is the case in the world of C++.

In need of some old-fashioned source code to perform the tests, we turned to the JMark 1.0 benchmark test suite that debuted in our PC Tech feature "Java Speed Trials" (October 22, 1996). The code not only provided a fairly large Java application (most Java applets are small animations) but also let us run the code when we were finished to produce a set of repeatable scores for each Java tool. Given their newness, the Java tools we tested astonished us with their advanced nature.

STRATEGIES FROM IBM, MICROSOFT, AND SUN

Different makers of Java tools have embraced different strategies. IBM articulates a vision in which Java components

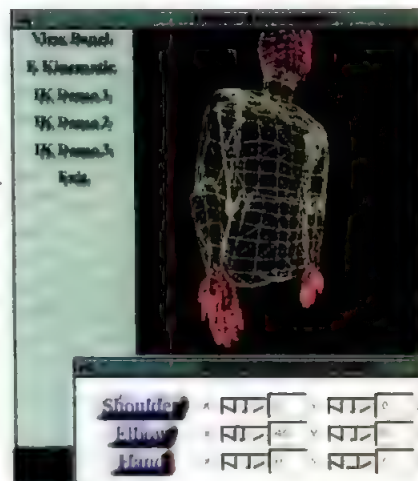
run together on a variety of platforms, including larger computers. Microsoft touts Java along with its own ActiveX Web component strategy. And Sun is generating enthusiasm for its tool, which uses Java and HTML, and for its JavaBeans component model, an alternative to ActiveX. During

the review process, we tried to keep the big picture in mind for each product as well as focus on the nitty-gritty.

Whatever happens to Java, it's clear from our weeks spent with the tools that this new language is making waves. The pace of innovation surrounding Java stands to get a big boost from tools that are surprisingly sophisticated despite their youth.

Testing the tools was an exhausting undertaking but one that immersed PC Labs staff in one of the most exciting developments surrounding the Internet.

The only constant may be change, but we've attempted to pin things down—at least temporarily. Take a look at our assessment of Java tools in this issue and see if you agree.—*Richard V. Dragan*



BEYOND APPLETS: Developers are using Java to create such apps as an interactive subway map (top) and a 3-D animator.

Mom-And-Pop ISPs

Can small ISPs survive?

Small Internet services providers, with a core of nearly 4,000 American entrepreneurs, are both endangered and fortunate. They face ominous competition from the likes of AT&T and MCI, but new technologies from companies such as Lotus, Rockwell, and U.S. Robotics are coming along to fuel those small ISPs' fires.

Surveys from *Boardwatch Magazine* show that 50 percent of regional ISP companies have fewer than six employees. Market-research firm Computer Intelligence reports that the companies it surveys—organizations that rely on computer technology—are using local ISPs instead of big national carriers. Computer Intelligence's research shows a marked increase in dependency on smaller ISPs.

The opportunities for the little guys haven't been lost on Lotus Development. Lotus just rolled out a new product family aimed specifically at ISPs that want to sell more than just connect time. Domino is the Web-enabled server based on the Lotus Notes groupware

system. Instead of being tied to proprietary applications, clients can use Web browsers to view Domino databases containing e-mail and other documents.

Lotus's new Domino Service Provider Applications make a single Domino server into a shared resource, with built-in capabilities for billing, management, and upward scaling. These applications provide group discussion, file libraries, calendaring and scheduling, and task management services for an ISP's clients.

Two emerging technologies—a new protocol and new modems—offer more significant opportunities for ISPs. Point-to-Point Tunneling Protocol (PPTP), developed by Microsoft and U.S. Robotics, makes it safe and practical to link the Internet into your intranet and to use Internet connections for remote corporate access. PPTP encapsulates data and delivers it to a Microsoft Windows NT Server. The server vouches for the validity of the sender, eliminating both the hassle of admin-



istering remote-access servers and the threat of spoofing and other forms of intrusion. PPTP is good for ISPs, because they can sell Internet connections as secure and inexpensive links into corporate networks.

The technology for 56-Kbps modems, developed separately by Rockwell and by U.S. Robotics, allows ISPs to offer higher-speed connections at lower costs.

These devices, expected out in mid-1997, aren't meant for general-purpose use. The destination device must have a dedicated high-speed circuit into a frame relay or dedicated digital network—something every ISP has.

Although not every Internet service provider is likely to flourish, the ones able to find the resources to invest in new technologies and protocols are likely to become an integral part of their clients' businesses.

—Frank J. Derfler, Jr.

JAKE KIRCHNER

PCs Are Too Hard to Use, But So What?

Personal computers are still too hard to use, but it just doesn't matter. Please excuse my contrary point of view, but I simply don't believe that the supposed difficulties of using a PC are seriously hindering sales, particularly of home computers.

I'm not saying PCs have reached user-interface perfection—far from it. Of course, PCs should be easier to use, and the sooner the better. Every major vendor is already struggling to enhance ease of use. But in the meantime, those same vendors are selling machines faster than they can make them.

Then how do we explain the continuing chorus that PCs are too hard to use? The stridency and urgency of the complaints would lead you to believe we're facing a national technical crisis of a magnitude not seen since the launch of Sputnik. Recently, I watched Mark Andreessen, Netscape's chief technology officer, as he told a national TV audience that he can't use his home PC because it's just too difficult and too unreliable.

If Andreessen, the inventor of the graphical Web browser, can't use a PC, does the industry have a serious problem, or what? On the other hand, I know that my children have been using PCs for years without the benefit of any instruction from me and without ever having read a manual—at least as far as I can tell. What do they know that Andreessen doesn't?

Soon after my brother's family unboxed its first PC, my three-year-old nephews Peter and Alex and their six-year-old brother



Nicholas all knew how to load a CD and find the programs they wanted—Nicholas by reading and the twins by memorizing the icons. They quickly learned their way around their favorite CD programs and learned to close the program when they'd finished. Maybe Andreessen should go live with the boys for a couple weeks get some remedial computer training.

Granted, these children are not mastering 3-D spreadsheet pivot tables, but they are using applications appropriate to their needs. And their use of the computer in addition to their parents' word processing and personal finance work justify the cost of the computer, even if the machine could still be easier for everyone in the family to use.

Okay, on a more serious note, of course Andreessen's statement was made to illustrate a point—and probably to help promote the sale of alternative approaches to Wintel computers. But 100 million people out there are using PCs. Many of them can't change the oil in their cars or program their VCRs, but they know how to work a piece of electronic equipment that's supposedly just too hard to operate.

I figure that the people who don't buy computers today either have no use for PCs or can't afford them. Those who don't need PCs today, though, will probably own them eventually, as the machines converge with TVs and game players. And other consumers will become buyers as soon as the prices come down enough.

PCs will continue to get easier to use and more and more people will buy them, but the two trends are only marginally related.

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21" MF-8221E (19.5" vis)	.27mm Flat Square	94 kHz	76 Hz (1600 x 1200)	\$1,585
17" MT-9017E (16" vis)	.25mm Aperture Grille	92 kHz	72 Hz (1600 x 1200)	\$799
17" MF-8617E (15.75" vis)	.26mm Flat Square	86 kHz	69 Hz (1600 x 1200)	\$690
15" MF-8515F (13.9" vis)	.28mm Flat Square	66 kHz	80 Hz (1024 x 768)	\$374

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Trends PCs

WORKSTATIONS

The Personal Workstation Is Coming of Age

What do you get when you cross a personal computer with a graphics workstation? A personal workstation, of course. This nascent product category has been made possible by the confluence of Microsoft Windows NT and the Pentium Pro processor. Powered by one or more Pentium Pro CPUs, Windows NT, Version 4.0, a cutting-edge graphics accelerator, and a SCSI storage subsystem, personal workstations are as flexible as mainstream PCs yet as powerful as high-end Unix systems.

Drawing on its extensive experience with both Unix workstations and PCs, Hewlett-Packard Co. is now offering the **HP Vectra XW Personal Workstation** (800-752-0900, www.hp.com/go/vectra). Available with single- or dual-200-MHz Pentium Pro processors, the Vectra XW has an AccelPro TX 2500 3-D graphics subsystem—

which provides OpenGL support—a SCSI-2 hard disk, an integrated Ultra SCSI controller, and an HP DeskDirect PCI 10/100Base-T card. Prices range from \$8,249 for a single-processor machine with 64MB of RAM and a 4GB hard disk to \$10,874 for a dual-processor system with 128MB of memory.

Competing for the same market is Compaq Computer Corp.'s **Professional Workstation 5000** (800-652-6672, www.compaq.com). At the low end of this line is a \$4,300 200-MHz single Pentium Pro system with 32MB of RAM, a 2GB hard disk, and a Matrox Millennium graphics card with 2MB of WRAM. At the other end of the spectrum is a \$10,200 dual-processor Pentium Pro/200 workstation with

128MB of RAM, a 4.3GB hard disk, and a 3-D ELSA Gloria-L graphics accelerator board. These SCSI-based systems are also



GET PERSONAL:

Personal workstations from Hewlett-Packard (top) and Integrated Computer Systems (right).

equipped with an 8X CD-ROM drive and an integrated Compaq NetFlex-3 Fast Ethernet controller.

Intergraph Computer Systems (800-763-0242, www.intergraph.com/ics), which now has three **Pentium Pro Personal Workstations**, has its sights set on competing

with Silicon Graphics' machines. The **TD-310**, **TD-410**, and **TD-610** lines are single, dual, and quad 200-MHz Pentium Pro systems, respectively. These systems are founded on integrated G95 graphics (for CAD professional and desktop publishing applications) but can be augmented with Intergraph's Intense 3D add-in card, which is optimized for OpenGL applications to speed animation and 3-D modeling.

Supporting up to 1GB of ECC

memory, each of these systems is equipped with an Ultra SCSI subsystem, an integrated 10/100Mbps Fast Ethernet adapter, and an 8X CD-ROM drive. The TD-310 starts at



\$4,995 with 32MB of memory, a 2GB hard disk, and G95 graphics, while the TD-610 begins at \$13,333 with 32MB of RAM, a 2GB hard disk, and G95 graphics.—Cade Metz

PDAs

Pocket Rockets

Looking for a PDA that connects with your PC painlessly?

Psion (800-997-7466, www.psioninc.com) has two new PDA offerings. The **Psion Series 3C**, which starts at \$599 for a unit with 2MB of RAM, has a backlit screen and an on-board RS232 fast serial port. There's built-in support for such mail systems as Lotus cc:Mail and Microsoft Mail, and a word processor, a spreadsheet, an agenda, a database, and a digital voice recorder. An Internet mail and Web browser software module is available for \$49.99, and you can add a PC Card reader for \$139.



The **Psion Siena** organizer, which starts at \$249 for a unit with 512K of RAM, features a numeric keypad, a word processor, and a spreadsheet. The Series 3C and Siena lines offer IrDA-compatible infrared capability for wireless transmissions; you can use the \$99 PsiWin 1.1 PC software for exchanging data be-

MINI WINDOWS: Psion's Siena (above) and Franklin's BookMan Sidekick (right).

tween either system and your PC.

The \$44.95 **FlashLink 95 PC Organizer** from Royal Consumer Business Products (908-526-8200, ext. 6657, www.royalnet.com) makes no pretense of being a PC in your pocket. With 8K of memory—

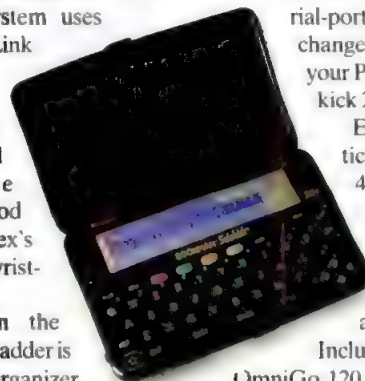
room for about 400 entries—a 2-line, 12-character-wide screen, and a small keyboard, the unit is a rudimentary repository for keeping such frequently used information as names and appointments. You don't need a cable to move data to and from the FlashLink 95, because the system uses Timex Data Link software and your PC monitor to download data—the same method used by Timex's Data Link wrist-watches.

Higher on the evolutionary ladder is a palmtop organizer from Franklin Electronic Publishers (800-266-5626, www.franklin.com). **BookMan Sidekick** combines Franklin's BookMan platform of cartridge-

based PDAs with a version of Starfish Software's Sidekick PIM in the unit's ROM. The \$89.95 model comes with 128K of memory and a 4-line, 27-character-wide display; the \$229.95 model has a 10-line, 40-character-wide display and 1MB of memory. A serial-port cable lets you exchange data between your PC and either Sidekick 2.0 or Sidekick 95.

Even more sophisticated is HP's (800-443-1254, www.hp.com/handheld) \$399 **HP OmniGo 120 Organizer Plus**, which has a backlit screen.

Included with the OmniGo 120 is Intuit's Pocket Quicken, and address, telephone, and appointment books. The \$49 HP Connectivity Pack provides for PDA-to-PC file transfers via a serial-port cable.—Robert S. Anthony



YOU

DELL DIMENSION™ XPS P200s

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★ Upgrade to 64MB SDRAM, add \$275.

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Business Lease*: \$96/Mo.

Order Code #501219



If you're shopping for a new computer, the December 3 issue of *PC Magazine* has some very interesting reading.

To begin with, they tested 51 200MHz



Pentium processor-based systems from 41 different vendors. Each system was configured the same way.

Each test was conducted under the same conditions. In the end, the Dell Dimension XPS P200s came out as the winner of the Editor's Choice Award for Pentium chip-based systems.

Perhaps the editors of *PC Magazine* said it best when they called the Dell Dimension "...an ideal machine for the small-office/home-office set."

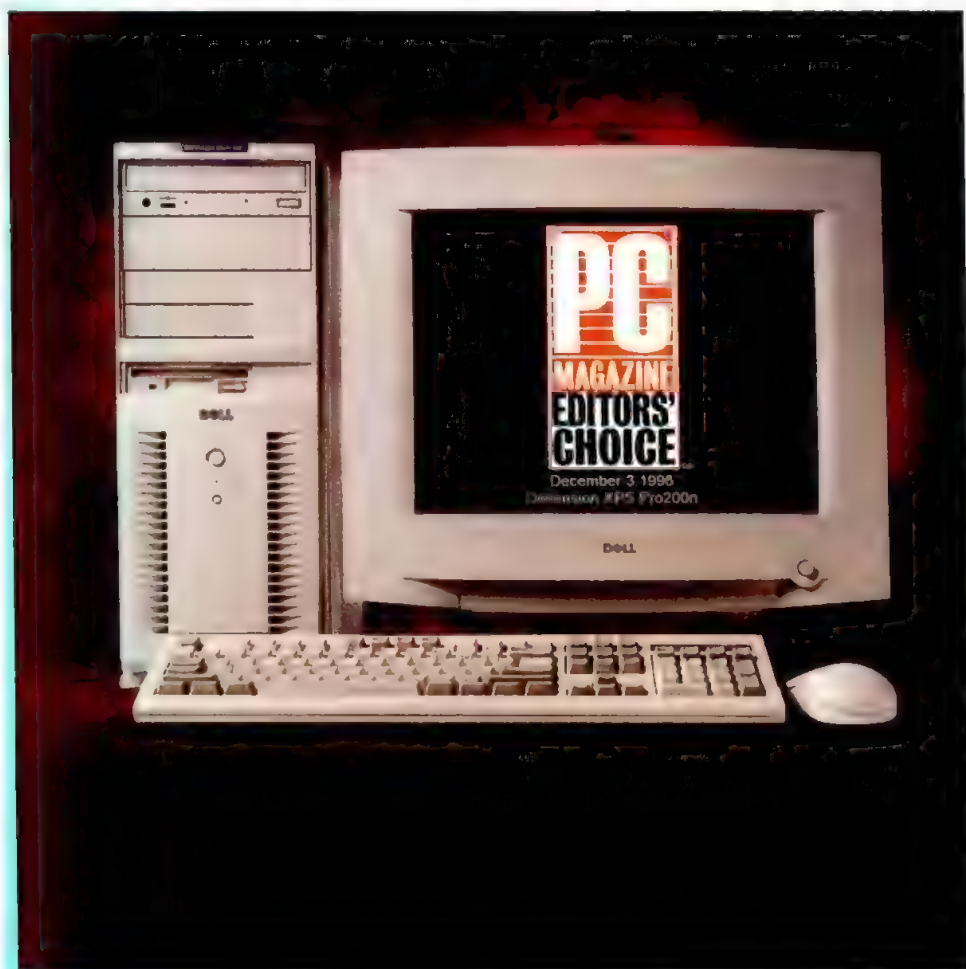
Another clear win for our customers.

In the same issue, *PC Magazine* went on to test 40 200MHz Pentium Pro processor-based systems from 38 computer vendors. Again, the tests were exhaustive. And again, Dell came out the winner of the Editor's Choice Award for Pentium Pro chip-based systems.

They said, "Everything about the [Dell] Pro200n is big and fast, from its hard drive, to CD-ROM

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200MHz PENTIUM PRO PROCESSOR

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- ★ Upgrade to 64MB EDO Memory with ECC, add \$340.

\$2999

Business Lease: \$111/Mo.
Order Code #501220

drive, from its fax/modem to its monitor."

Compelling praise indeed. But there's more.

The Editors went on to say, "The award in the Pentium Pro round-up testifies to Dell's ability to build a machine not only perfect for mainstream users but one for the corporate set running Windows NT as well."

You may wish to note that the Editors of

PC Magazine aren't the only people who rate Dell highly. The subscribers of the same publication gave Dell a "significantly better than average" rating in their annual subscribers' study for service and reliability.

So there you have it. Two powerful machines. Two prestigious awards. One clear winner.

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PROJECT MANAGEMENT

The Project Planning Pros

For those who are seeking more powerful and innovative project control solutions, the following packages address project managers' changing needs. These packages offer greater customization, additional help

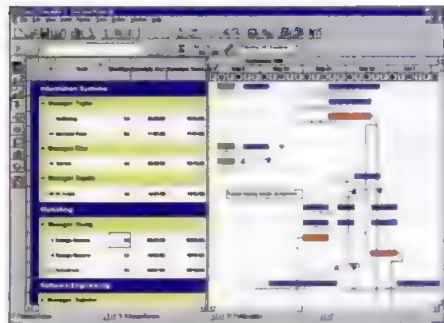
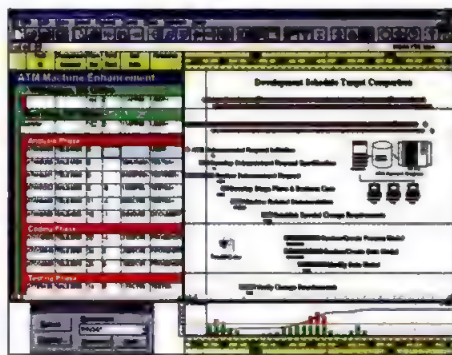
options that enhance ease of use, and Internet and e-mail functionality.

Priced at \$595, **Project Scheduler 7**, from Scitor Corp. (800-533-9876; www.scitor.com), builds upon its project management methodology by placing custom formulas to the right of tasks. Project Scheduler 7 also incorporates Internet technology by providing an HTML publishing feature that enables you to post project status reports directly on the Internet.

With Primavera Systems' high-end \$4,000 **Primavera**

Project Planner 20, you get ten times the activities, more sophisticated analysis, and tighter project control than you do with SureTrak, Primavera's \$399 low-end project management tool. Primavera has plans to release the next version of SureTrak sometime this spring.

Project Planner provides activity logs that link to URLs, and its help capabilities can lead you directly to the technical-support section on Primavera's Web site for timely tips and pointers (800-423-0245, www.primavera.com). Project Planner's new SendMail Wizard—a VIM/MAPI feature—requests status reports from those working on a project and those responsible for specific



PLAN AHEAD: Project management software from Scitor Corp. and Primavera Systems (above right).

tasks as well. Although this is still a 16-bit package, it runs on 32-bit systems as well; the next release will be a native 32-bit version.

In the meantime, Microsoft Corp., whose latest entry into the project management field was last year's **Microsoft Project for Windows 95**, has plans to introduce another package by the middle of 1997.—Yvonne Koulouthros

CLIP ART

Art for Any Occasion

Looking for just the right image for your latest report, project, illustration, or desktop publishing effort? Here's a selection of clip art and stock photography that is bound to satisfy your needs.

If you're looking for variety, look no further than the \$79 **CorelMega Gallery** from Corel Corp. (800-772-6735, www.corel.com). This comprehensive CD-ROM features over 110,000 images, photos, fonts, sounds, and animations covering every topic imaginable. There are 50,000 vector clip-art images and 60,000 ready-to-use, low-resolution, royalty-free photos.

Similarly vast in scope and content is the \$60 **MasterClips 101,000 Premium Image Collection** from IMSI (800-

833-4674, www.imsisoft.com).

Does your professional life involve science, technology, or medicine? Phototake and Peter Arnold have joined to offer the \$19.95 **Sci-Med 5000** (800-542-3686), a CD-ROM for the Power Macintosh, with a library of low-resolution stock photography and illustrations. The collection includes over 5,000 images, covering the sciences, technology, biology, and more. Images can be used royalty-free for compositional purposes; once you've decided on an image, you can purchase a license for the high-resolution version. (Prices vary according to how the image is used.)



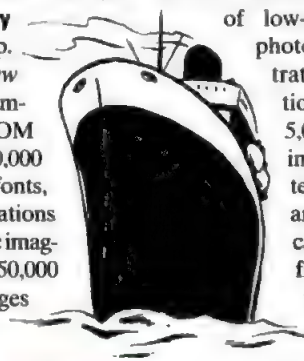
If you want a more three-dimensional look, the \$99 **3D-PIX** from Cause & Effect Productions (800-962-2998, www.3dpix.com) offers over 120 fully rendered 3-D images from a number of categories, including business, sports, and science.

Step back to the 1940s and get **In the Mood** (\$59 per volume; \$229 for a 10-volume set). This classy CD-ROM collection from Havana Street (800-460-7624, www.eden.com/~havana) features clip art designed to recall the hand-drawn style used in 1940s print ads. There are over 1,700 black-and-white, editable vector images covering ten diverse subjects areas. The art is digitized from images drawn by two professional illustrators.

For dedicated collections of royalty-free, professional photographs, IMSI is offering the \$29.95 **MasterPhotos 25,000 Premium Photo Collection**. The package includes high- and medium-resolution color images, as well as 7,500 black-and-white historical photographs.

Artville (800-631-7808, artists@artville.com) is planning to release CD-ROMs featuring original illustrations and photographs by professional graphics artists. You pay a one-time fee—ranging from \$59 to \$300—for access to all images on a disk. Each disk features work by an individual artist or photographer, and includes a the artist's biography and contact information.

Foregoing CD-ROMs altogether is Digital Stock Corp. (800-545-4514, www.digitalstock.com), whose Web site allows keyword and natural-language, online searching through thousands of Digital Stock images. Images are available in sets of 100 on CD-ROMs, which are categorized by subject matter. Any title ordered online costs \$239, and you receive free next-day shipping if you live in the U.S. (Titles that are not ordered online cost \$249 each, plus shipping.)—Melissa J. Perenson



DESIGNER ART: Clip-art selections from *In the Mood* and *CorelMega Gallery* (right).



Trends Peripherals

DIGITAL CAMERAS

Focusing on Snapshots



Digital photography has long involved a trade-off between image quality and the immediacy of manipulating pictures with a computer. Although they arrived too late to be included in our feature story, "Heave-ho, Silver!," in this issue (page 145), the newest entries in this field go beyond merely taking snapshots by offering such features as support for audio and IrDA transfers.

The \$999 **RDC-2b** from Ricoh (800-225-1899, www.ricohcpg.com) offers an intelligent design that includes a flip-top LCD viewfinder and control panel. The camera has five different capture modes that give you such functionality as the ability to record sound, textual detail, and continuous action. With a 410,000-pixel CCD, the RDC-2b can store 24-bit color images at resolu-

tions of 768 by 576, either in the unit's internal flash memory or on standard ATA PC Cards.

Sony Electronics (800-352-7669, www.sel.sony.com) is trying to prove the adage that good things come in small packages with its first consumer-oriented digital camera, the \$850 **Sony DSC-F1**. Packed into the camera's sleek body is 4MB of internal flash memory and a 1.8-inch LCD.

If you purchase the optional \$500 **DPP-M55** dye-sublimation printer, you can output your digital photographs to high-quality, 5.5- by 3.9-inch prints. The camera features a built-in infrared transceiver, so images can be transferred to an IrDA-equipped laptop or printer at 1.1 Mbps, without the use of wires.

A longtime industry leader in professional photography, Nikon (800-526-4566, www.nikonusa.com) has applied its know-how to the design of a new series of point-and-shoot

digital cameras. The entry-level, slimline \$529 **Coolpix 100** offers 512-by-480 resolution and a 1/3-inch CCD with 330,000 pixels.

The unit features programmed auto-exposure control that uses variable shutter speeds from 1/45 to 1/10,000 of a second, has a maximum aperture of f/4 with a 6.2-mm normal-focal-length lens, and includes a built-in electronic flash and macro close-up focusing. The Coolpix 100 is PC Card-based; transferring images is as simple as saving them to the PC Card. The higher-end **Coolpix 300**, which isn't due until early spring, delivers a maximum image resolution of 640 by 480.

Its large, 2.5-inch LCD panel lets you preview images as you're shooting them. You can use the LCD panel and included stylus to annotate your images, and you can capture audio snippets to accompany the digital photos as well.—*Jeremy Olshan*

RECAP Reviews of these digital cameras have appeared in First Looks: Fuji's Fujix DS-220 (October 8, 1996); Kodak's Digital Science DC-20 (September 10, 1996); and Polaroid's PDC-2000/40 (July 1996).

HARD DISKS

Serving Up Bigger, Faster

In this space last issue, we discussed the latest hard disks available for desktop PCs. But disk manufacturers have been busy at the server level too. Bigger, faster server-capacity hard disks are being rolled out, and they'll soon be available from a system integrator near you.

Micropolis (800-395-3748, www.micropolis.com) has released its new **Tomahawk** family of drives. The 7,200-rpm Ultra SCSI units are available in 4.6GB (\$1,630) and 9.1GB (\$2,900) capacities and boast average seek times of about 8 ms with a sustained data rate of 9.5 MBps.

Seagate Technology (408-438-8111, www.seagate.com) will offer the **Cheetah** family of 3.5-inch drives for network- and

multimedia-server-level PCs. These will be the first hard disks to hit the 10,000-rpm plateau; the previous generation of performance drives topped out at 7,200 rpm. The higher rotational speed delivers average seek times as low as 7.5 ms and average sustained data-transfer rates of up to 14 MBps. The Cheetah's four-platter design holds 4.6GB of data in a 1-inch-high form factor, while the eight-platter, 1.6-inch-high version holds 9.1GB. (Pricing was unavailable at press time.) Ultra SCSI and Fibre Channel versions went into production at the beginning of the year and should start appearing in servers soon, probably within the next few months.—*Jamie Bsates*

WIDE-ASPECT DISPLAY

For those of you who have been pining for a monitor that lets you display two 8 1/2- by 11-inch pages side-by-side with room to spare, Sony Electronics (800-352-7669; www.sel.sony.com) has a wide-screen solution. The Sony GDM-W900 is a display that uses a 24-inch tube (measured diagonally) and delivers the more rectangular 16:10 aspect ratio of HDTV (not the squarer 4:3 ratio of current TVs and monitors). The 1,920-by-1,200 resolution means more screen real estate for users and represents a particular boon to desktop publishers, CAD users, air-traffic controllers, and Web surfers and developers. With pricing expected to be



about \$5,000, you won't see one of these displays on every desktop anytime soon. But Sony may be teasing us with a peek into the future, when wide-aspect displays may well become the norm.—*Toni Kistner*



SURE, A MONITOR SHOULD BUT IT'S WHAT'S ON THE

At Compaq, we haven't forgotten what you look for in monitors. Still, we think there should be more to them than just sharp, crisp images (not that there's anything wrong with that). Which brings us to our new line of monitors.

The first thing you'll notice is their sleek new design and advanced on-screen controls for easy and precise adjustments. Of course, upon closer inspection, you'll see

they've been engineered through and through to the same high standards that have made our PCs among the best on the planet. Which is why the line features a complete range of innovative monitors. Everything from a value series — including our V50 15" (13.77" viewable) — to high-performance models like our QVision 210 21" (19.5" viewable).

Of course, there's also our P70, a 17" (15.68" viewable)



The Compaq V70 monitor won both the PC Magazine Editors' Choice award and the Windows Magazine Best award in October 1996. The Compaq QVision 210 monitor won the PC World Best Buy award in January and November 1996. * When used with Compaq CPUs which feature Intelligent Manageability. © 1996 Compaq Computer Corporation. All rights reserved. Compaq registered U.S. Patent and Trademark Office. QVision 210 is a trademark of Compaq Computer Corporation. Other products mentioned may be trademarks or registered trademarks of their respective companies.

P70



OULD BE NICE TO LOOK AT. E INSIDE THAT COUNTS.

Trinitron tube monitor that delivers an impressive 85 Hz at a resolution of 1280 x 1024. You'll find it's perfect for graphic-intensive applications as well as Windows 95 and Windows NT.

Speaking of features, all monitors provide the very things you've asked for. Like best-of-class refresh rates at superior resolutions. There's also anti-glare technology for reduced eye strain. Even Intelligent Manageability capabilities that let

you track inventory and manage problems across a network.*

In other words, the line embodies everything you've come to expect from Compaq. Substance. Quality. And, yes, even good looks. To learn more, visit us at www.compaq.com or call 1-800-869-6865.

COMPAQ

Has It Changed Your Life Yet?

E-MAIL UTILITIES

Consolidating Messages

Used to be you had to use a separate interface for each of your e-mail accounts. Four packages hope to change that situation by offering what is as close to a uni-

messages across multiple services, including America Online, CompuServe, MCI Mail, Prodigy, any Internet service provider (ISP), and any LAN e-mail system. You

can also send faxes and pages from within EMail Connection.

EMail Connection uses S/MIME technology in combination with RSA Data Security's public-key encryption; this version also adds support for VeriSign's digital signatures technology, Digital ID. And you can now import your address and old

message databases from Eudora and CompuServe's WinCIM.

Backed by a user-friendly, office desk-metaphor interface, the \$49 **Magic Cap for Windows 95**, from General Magic (888-239-4824, www.genmagic.com/mcw), is targeted at the home- and small-



UNIVERSAL IN-BOX: General Magic's Magic Cap and Wall Data's Rumba Mail (above right).

versal e-mail in-box as you can get.

ConnectSoft's \$49.95 **EMail Connection 3.1** (800-889-3499, www.connectsoft.com) is the latest upgrade to a product that was one of the originators in this category. EMail Connection automates the retrieval and filing of your e-mail



package manages not only your e-mail flow, but it handles all da-

ta, voice, and fax communications as well. New to this version is alphanumeric paging and support for Microsoft Windows NT workstation 3.51 or later. There's also support for TAPI and MAPI 1.0.

Tackling the LAN- and WAN-based e-mail market is Wall Data's **Rumba Mail Featuring 3M's Post-it Software Notes** (800-915-9255, www.walldata.com/rmail). Prices start at \$149 per user. With a single interface, Rumba Mail lets you access multiple e-mail systems, including America Online, Lotus cc:Mail, Lotus Notes, Microsoft Exchange, Microsoft Mail, IBM's Office Vision/400, and any Internet e-mail. Integrated into Rumba is 3M's Post-it Software Notes, so you can add annotations that look like yellow sticky notes to documents you're sending; recipients who do not have Rumba Mail or Post-it Software Notes installed receive the add-on notes as regular text messages.—*Melissa J. Perenson*

office market. Magic Cap supports e-mail communications via any POP3 ISP or America Online. A versatile, universal address book captures the addresses of incoming messages and makes it easy to send faxes and to page via the Sky-Tel paging system. The software is integrated with Microsoft Internet Explorer 3.0, which comes with Magic Cap. If you're sending a

RECAP In our roundup of e-mail packages (October 8, 1996), we awarded Editors' Choices to
 ▶ Pronto 96
 ▶ Microsoft Internet Mail
 ▶ Netscape Navigator Gold 3.0

message to another user of Magic Cap's software, you can stamp a letter as urgent or priority, or add a graphic, animation, or audio clip.

Taking the universal in-box concept one step further is Global Village Communication's \$89 **FocalPoint 5.5** (800-329-9675, www.globalvillage.com). This 16-bit

BROWSERS AND E-MAIL

A Child's View of the Web

Are Netscape Navigator and Microsoft Internet Explorer the right solutions for your Internet-surfing kids?

InterGO Communications (972-424-7882, www.intergo.com) and ConnectSoft (206-827-6467, www.connectsoft.com) each have packages that provide children with a means of accessing the Internet safely and easily. And they offer environments that are specially tailored for the young ones in your family.

The \$49.95 **InterGO** has updated its Web browser to support HTML 3.0 tags and plug-ins.

The integrated, site filtering—

KinderGuard—determines site appropriateness by age group (ages 3+, 6+, 13+, 17+, and 21+). InterGO also provides support



KID-FRIENDLY: ConnectSoft's KidWeb browser.

for the RSACi rating system. The program can filter out objectionable content from news-groups, search results, and

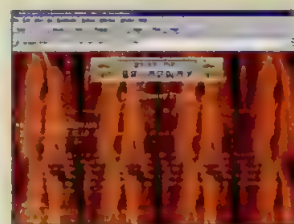
e-mail, as well as from IRC chat, a feature new to this version.

From ConnectSoft comes the \$39.95 **KidWeb**, a browser designed for children aged 6 to 10. Beneath its child-friendly, animated interface, KidWeb offers impressive customization features for parents. Using ConnectSoft Access Controls, parents can customize access parameters for each child by listing banned sites or keywords, or by creating a list of approved sites.

Access Controls is also the filtering utility for ConnectSoft's companion product, **E-Mail for Kids, Version 3.0**. Priced at \$29.95, this package lets kids have their own e-mail interface to your account; there's support for all of the major online services, cc:Mail, MCI Mail, and Internet e-mail. You can opt to screen both incoming and outgoing mail for content.—*David Lidsky*

COOL WEB SITE

www.ticketmaster.com



TICKETMASTER ONLINE now offers online selection and purchase of Broadway show tickets. You can access information—including theater seating charts—and buy tickets for any Broadway show sold through Ticketmaster. This service is ideal for anyone who's in New York—or plans to be—and wants to take in a stage play or musical. Ticketmaster hopes to expand the service to include tickets for events nationwide early this year.—*DL*

ROAD WARRIOR ALERT

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- 120 MHz Intel Pentium® Processor
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Trends Networking

NETWORK COMPUTERS

Long Live the Network

A new type of PC is on the way—and this one is as much a step backward to the days of the dumb terminal as it is a step forward. Although it won't let you play a music CD or insert a floppy disk, a network computer, or NC, will let you access everything you need for getting your work done—applications, files, and so on—from your internal network.

Thus the network computer. Boundless Technologies, Sun Microsystems, and Wyse Technology will soon offer NCs. These machines will shift PC support from the desktop to the network, and the battle cry is low administrative costs.

Boundless Technologies (800-231-5445, www.boundless.com), which was formerly known as Sun-

River Data Systems, will have an entire line of network computers. At the high end is the \$799 **XLC Network Computer**. It delivers multi-



user access to DOS, Microsoft Windows 3.1, Windows 95, and Windows NT, the Internet, corporate intranets, Java applets, Unix/X Window, and 3270 legacy systems. The \$549 **TC** offers access only to Windows 3.1, Windows 95, and Windows NT. Each unit comes with a processor, keyboard,



GET CONNECTED: Network computers from Sun Microsystems (left) and Boundless Technologies (above).

and mouse, but a monitor must be purchased separately.

Spotlighting its Java operating system, Sun Microsystems (800-555-9786, www.sun.com) is unveiling its own family of NCs. The **JavaStation** features the Java OS, a set of products called HotJava Views, which are desktop productivity applets, and the HotJava browser. In addition, JavaStation lets you access Microsoft PC applications from a Windows NT serv-

er via Insignia Software's application server, NTrigue. Sun's entry-level JavaStation will cost \$742 and comes with 8MB of RAM. A JavaStation with 8MB of RAM, a keyboard, a mouse, and a 14-inch monitor costs \$995. The top of the line, which has 16MB of RAM, a

keyboard, a mouse, and a 17-inch monitor, goes for \$1,565.

Also in the Java vein is the **Win-term 4000** series of enhanced network computers from Wyse Technology (800-800-9973; www.wyse.com). Due early this year, these systems will provide access to all Windows, Java, HTML, and legacy system programs on the network. Wyse licensed the Java OS from Sun for this product line. The top-of-the-line **4700 SE** will include a keyboard, a mouse, and a 15-inch monitor for less than \$1,000.—*Sarah L. Roberts*

TELEPHONY

Making Calls...for Less

Soon, when you think of making telephone calls via your computer, an Internet phone may be the first image that comes to mind. Companies such as Micom, Mitel, Motorola, and newcomer Vienna Systems, however, are working to transmit voice communications by using existing networking backbones and technologies, such as ATM, frame relay, internal IP networks, and the Internet.

This means that businesses will also be able to enjoy the advantages of Internet phones by bypassing the traditional telephone companies to make less expensive long-distance calls to and from branch and remote offices.

Frame relay is Motorola's (800-668-6765, www.mot.com) networking flavor of choice. In

contrast to ISDN's dial-up approach, frame relay offers instant network access. Motorola's latest product, the \$999 **Vanguard 100**, lets you place voice calls on your frame-relay connection. Motorola's proprietary compression technology helps to transport the voice, and its use of digital speech interpolation minimizes wasted bandwidth.

NeVaDa is Mitel's offering in the voice arena (800-648-3579, www.mitel.com). This product, which sells for between \$600 and \$800 per voice port, is what Mitel calls a voice-LAN networking solution. Developed in conjunction with Madge Networks, the venerable switching technology company, NeVaDa uses ATM to transmit voice.

Vienna Systems (613-591-3219, www.viennasys.com), a

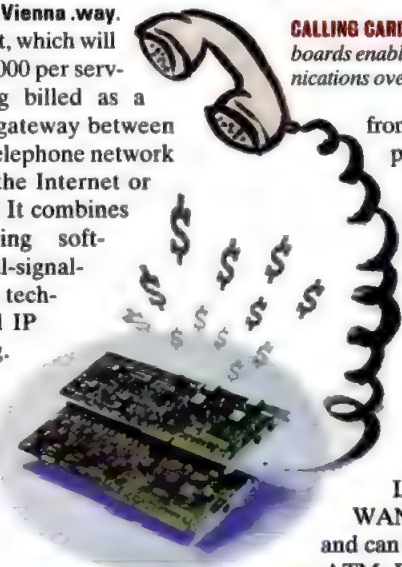
start-up company and recent affiliate of Newbridge Networks, is working on its own variation of this idea, **Vienna.way**.

This product, which will sell for \$12,000 per server, is being billed as a multipoint gateway between the public telephone network and either the Internet or an intranet. It combines call-processing software, digital-signal-processing technology, and IP networking. The product will route calls across the Internet or a private IP network.

From Micom (800-642-6687, www.micom.com) comes the **V/IP**. The V/IP, which sells for \$770 per voice/fax channel, is a phone/fax IP gateway that

creates an overlay voice and fax network on top of an enterprise IP data network. Micom says that

CALLING CARDS: The V/IP's boards enable voice communications over the Internet.



from any telephone or fax machine a user can make free intracompany calls of the same quality as the phone network provides. The V/IP is independent of LAN and WAN technologies, and can therefore run on ATM, Fast Ethernet, frame relay, and other types of networks. The product consists of analog and digital voice interface cards that plug into a single PC at each enterprise location.—*SLR*

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First Looks



CD-ROM Jukeboxes

Shuffle as many as six CD-ROMs at top speed with any of these affordable CD-ROM changers.—By Alfred Poor

Four-by-sixes, four-by-eights, five-by-tens...no, it's not another episode of "This Old House." It's the latest crop of CD-ROM changers, which help you manage four, five, or even six disks at once at up to 10X data throughput.

With the CD-ROM now the acknowledged software distribution media of choice, and many programs pushing to two, three, and even four disks, the need to move efficiently among a stack of CDs is ever pressing. Some solve the CD shuffle by adding a second CD-ROM drive, but they still have to swap disks when they need to use a third title.

CD-ROM changers offer a

different approach. Like their single-disk brethren, these disk changers contain one CD-ROM reader, but they also have several disk bays and a mechanism for swapping the disks in and out of the reader for you on demand. So while the drive is working with one disk, the others are ready, waiting, and available at the click of a mouse.

WIN-WIN SITUATION

This is a win-win situation, because with a CD changer you don't give up anything. Each of the five units we looked at—Micro Design International's \$895 SCSI Express Mini-Changer, Nakamichi America's

\$400 MJ-4.8s, Panasonic Computer Peripheral's \$250 10X Big 5, Pioneer New Media Technologies' \$330 DRM-624X, and Smart and Friendly's \$500 CDJ 4008—was able to handle from four to six disks and move data at throughput rates that are every bit as fast as comparable single-disk units. Each was able to switch to any loaded disk in less than ten seconds, about the time it takes most of us just to locate the desired CD.

Although these five units are birds of a feather, there are some major differences among them. For example, only Panasonic's Big 5 used an IDE interface card; the others moved data via a SCSI-2 bus. And of the SCSI drives, only the Pioneer DRM-624X and Smart and Friendly CDJ 4008 included host interface cards.

The MDI, Nakamichi, and Smart and Friendly devices produced nearly identical performance figures, because they each use the same Nakamichi four-disk, 8X engine. But they offer markedly different packaging, features, and price. For instance, Smart and Friendly includes an Adaptec 1502-E interface with its drive, and it costs less than half the price of MDI's package—which comes without an interface. In addition, Smart and Friendly goes the extra mile with the inclusion of PowerTools—Adaptec's utilities—which let you assign a single letter for the drive or specify a different letter for each disk.

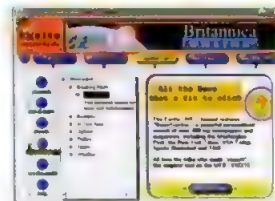
INSIDE-OUTSIDE JOB

While the Nakamichi and Panasonic reside in a standard half-height 5.25-inch-disk drive bay, the other three devices are external units. But no matter where you put your drive, these CD changers differ in how they load disks. All but the Pioneer

INSIDE

DON'T TOUCH THAT DIAL:

Marimba's Castanet Tuner is a remote control for the Internet. See Page 60 for a full review.

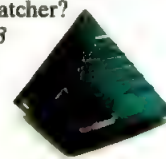


BEYOND MULTIMEDIA:

Cambridge SoundWorks' MicroWorks heralds the end of separate desktop and stereo speakers. For the full review, see Page 64.



AIR MAIL: Who needs an Internet connection to get the latest news when you've got NewsCatcher? See Page 73 for the full story.



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WWW.PCMAG.COM/DISCUSS.HTM



First Looks

Editors' Choice

- Panasonic 10X Big 5
- Smart and Friendly CDJ 4008



Moving data from a stack of silver disks to your PC takes a nimble

and well-rounded CD-ROM changer.

For all-around versatility and value, the Smart and Friendly CDJ 4008 is tough to beat, while the data throughput of the Panasonic 10X Big 5 is for the heavy data movers among us. These two exceptional drives are our Editors' Choice winners.

Other drives in the group used the same

work by being fed CDs individually through a slot or tray—an advantage if in general you swap only one or two CDs.

On the other hand, the Pioneer drive houses its disks in a six-disk cartridge, making it easy to preload cartridges with different sets of disks so that you can change them in one simple step. This is perfect if you want your five-disk CD phone directory in one cartridge, your three-disk set of Muppet Treasure Island in another, and several Corel Stock Library CDs in a third.

NEC, an early proponent of the disk changer (First Looks, February 20, 1996), is noticeably absent from this roundup. NEC has since discontinued retail sales of disk changers, but expect to see a new NEC-built changer in computer systems later this year.

Among the five drives we looked at, there's a lot to consider: data-transfer rates, ease of installation, and processor overhead. In the long run, DVD will eliminate the need for CD changers, but in the meantime if you've ever played poker with a handful of CDs and your CD-ROM drive, you'll want to consider making a CD changer an integral part of your system.

Nakamichi four-disk, 8X mechanism, but Smart and Friendly put together the most compelling package. As a single-user product, it comes with everything you need, including an Adaptec SCSI adapter and a good assortment of utilities for managing a database of CDs, assigning single or multiple drive letters, and playing audio CDs. And in case you want to hang this unit on a local area network, you also get useful CD-server management software in the bargain.

Panasonic's Big 5 is for those with a need for speed. The software for this five-disk, 10X drive was every bit as impressive as the Smart and Friendly package, but its blinding speed, IDE interface, and \$250 price tag will make many users think twice before going with a single-disk CD drive. You can find faster or cheaper drives, but you won't find one that provides more for less than the Panasonic Big 5.

Micro Design International

SCSI Express Mini-Changer

Micro Design International, which specializes in making peripherals for network installations, offers a hybrid disk changer that is just as appropriate for single-user installations as for a small LAN. But the MDI SCSI Express Mini-Changer's price tag of \$895 makes it clear that you pay for this flexibility.

The MDI drive uses the same Nakamichi four-disk, 8X CD engine as Nakamichi and Smart and Friendly. One look and you'll know that this external unit stands apart from the rest; it's the largest and heaviest of the group, and it's housed in a hefty case that can be stacked with other MDI drives. It comes with a minimum of software; the most notable included program is a NetWare Loadable Module (NLM) for setting up the MDI drive as a multiuser drive on a network.

The drive's case has two Centronics-style connectors, a power switch, and a digital SCSI ID selector on the back. Unlike the other two external models in this group (the Pioneer and the Smart and Friend-

ly), the MDI unit does not have stereo sound jacks.

The MDI's installation and configuration were fairly easy; Windows 95 immediately recognized the unit as four individual CD-ROM drives, each with its own letter. Unfortunately, this SCSI device is not self-terminating, and the MDI drive does not include a terminating block.

Disks enter and exit the drive via a single slot, and on our tests the MDI drive performed on a par with the other Nakamichi-based products and better than its 8X rating would sug-



gest. The unit's CD-ROM WinMark score was 621 thousand bytes per second (Bps), and the data-transfer rate for 4K records was 1,290 thousand Bps. The drive's average access time was 197 milliseconds (ms), and it took an average of 8.3 seconds to

move among loaded disks.

The MDI costs nearly twice as much as the next-most-costly drive in the group, but its \$895 tag is a list price, and the MDI can do double duty, on both the desktop and a network. If the changer is destined to play a key role in a network, then MDI's expertise in networks may play a factor in your decision. Stand-alone users, however, will want to consider another choice.

Nakamichi America Corp.

Nakamichi MJ-4.8s

Nakamichi America provides its CD drives to PC makers for resale and does not sell them directly to the retail market. As a result, its \$400 package is minimal as compared with the others in this roundup, but it still provides an appealing set of features and a reasonable value.

The internal SCSI-2 drive uses the same four-disk, 8X mechanism that is on the MDI and Smart and Friendly units. The drive is Plug and Play-compatible with Windows 95, which recognizes the drive immediately and assigns separate drive letters to the four disk bays. About the most difficult part of installation and setup is setting the jumpers for SCSI ID and termination. Included software is simple but sufficient: drivers and utilities for DOS, Windows 3.x, and Windows 95.



NETWORK READY:

With its inclusion of a NLM, the MDI disk changer can deal CDs over the LAN.



**SIMPLE,
BUT SUFFICIENT:**

The Nakamichi drive lacks some of the software bells and whistles of the other drives.

The drive's performance test scores were similar to the other two models that use the same engine. Its CD-ROM WinMark score was 640 thousand Bps, with a data transfer rate of 1,290 thousand Bps for 4K records—faster than its specification and a whisker ahead of the MDI unit. The average access time was 183 ms, and it took an average of 8.6 seconds to swap disks.

The Nakamichi MJ-4.8s may seem a bit Spartan, but it delivers value and performance.

Panasonic Computer Peripheral Co.

Panasonic 10X Big 5



One of the newest disk changers on the market, the Panasonic 10X Big 5 combines fast performance and low price. If to you speed is of the essence, go with the Big 5.

At a street price of \$250, the Big 5 is the least expensive drive reviewed here, and it costs less than many single-disk drives with similar specifications. The drive uses simpler technology; while the other drives are SCSI-2 devices, the Big 5 is an ATAPI/IDE drive, so you can just plug it into your motherboard's IDE connector. The price you pay for this convenience is that when the

drive is doing its job, it can take up most of your system's processing power.

Though the Big 5's 10X rating is more than double that of the Pioneer unit's, this extra speed won't add up to a quicker round with Duke Nukem, because the majority of software programs are still keyed to 2X or 4X playback. It will, however, speed data transfer and software installation.

The Big 5's loading mechanism is a bit different from the others. There are five separate CD trays; when you eject one, the tray is extended with a larger carrier that holds it steady. There are windows on each side so you can tell which CD is currently loaded in the reader and an optional adapter that lets you play smaller, 3.5-inch CDs.

The drive comes with drivers for DOS, Window 3.x, and Windows 95. Under Windows 3.x or Windows 95, you can choose to

have either five individual drive letters assigned or just one. There are also some helpful disk management utilities for creating a database of information about the disks in your collection.

Despite its 10X rating, the Big 5's performance on our CD-ROM WinMark test was a mediocre 576 thousand Bps because of disproportionately low data throughput on small records. But, as expected, it posted the fastest average access time—232 ms—of this group. The data-transfer rate for 4K records was an impressive 1,510 thousand Bps, and it took an average of 7.1 seconds to swap disks. A shortcoming of the Big 5 is that the drive sucked up processor power when it was running. Our tests show that the drive ran at nearly 90 percent CPU utilization, compared with 30 percent or less for the other drives—all SCSI drives that require less processing power. As a result, when the Big 5 is operating, chances are that your PC will not be able to do any heavy-duty work.

Yet top speed and low price combine to make the Panasonic 10X Big 5 a must-have peripheral.

Pioneer New Media Technologies Inc.

Pioneer DRM-624X

Living up to its name, Pioneer New Media Technologies was one of the first companies to offer disk changers for PCs. But although the Pioneer DRM-624X offers some advantages, the 4.4X design simply couldn't keep up with the others drives in this roundup.

The drive is rated at a maximum throughput of 676 thousand Bps, which is about half the speed of the other drives in this group. This performance deficit is more apparent in loading software and moving files than in playing CD games or educational titles.



FAST, FAST, FAST:

The Panasonic 10X Big 5 was the leader on most of our performance tests for playing and moving disks.

PERFORMANCE TESTS

CD-ROM Changers



Despite its 10X rating, the Panasonic 10X Big-5 had a lower ZD CD-ROM WinMark score than other devices—576 thousand bytes per second—because of its disproportionately low data throughput on small records. The Big-5 performed better, however, on tests with 2K and 4K records. The three Nakamichi-based

drives (the MDI, Nakamichi, and Smart and Friendly units) made up the wide middle of the group with greater than 8X performance.

In addition to using WinBench 97's CD-ROM WinMark tests, we timed these drives changing disks. We tested with a 486DX2/66 PC with 8MB of RAM, running Microsoft Windows 95.

	ZD CD-ROM WinMark	4K Sequential Read	Average access time	Average time to change disk	CPU Utilization
	Thousands of Bps ▲	Thousands of Bps ▲	Milliseconds ▼	Seconds ▼	Percent ▼
MDI SCSI Express Mini-Changer	621	1,290	197	8.3	21
Nakamichi MJ-4.8s	640	1,290	183	8.6	21
Panasonic 10X Big 5	576	1,510	232	7.1	88
Pioneer DRM-624X	445	645	195	9.2	11
Smart and Friendly CDJ 4008	620	1,290	188	8.6	21

▲ Higher scores represent better performance.
▼ Lower scores represent better performance.
Bold type denotes first place.

First Looks



Pioneer DRM-624X
Street price: \$330
Pioneer New Media
Technologies Inc
Long Beach, CA
800-444-6784, 310-952-2111
www.pioneerusa.com

SIX PACK:

The Pioneer DRM-624X can handle up to six CDs in a removable cartridge.

One key difference between the Pioneer and the other disk changers in this roundup is that with the Pioneer, instead of loading the disks one at a time, you use a six-disk cartridge. The cartridge approach—which has its roots in early car CD changers—is more convenient for keeping several cartridges preloaded than for changing one disk at a time. For example, you may want to keep all reference CDs—such as Microsoft Bookshelf and PhoneDisc—in a single cartridge.

The back panel of the external SCSI-2 device has well-marked switches for termination and a pair of RCA jacks for stereo sound output. The

Plug and Play device installs under Windows 95 as six separate drive letters.

As expected, the Pioneer was the slowest data mover of the five drives. Its CD-ROM WinMark score was just 445 thousand Bps, with an average access time of 195 ms. The data transfer rate for 4K sequential records was 645 thousand Bps, and the average disk swap took 9.2 seconds. The big surprise was that this drive had the lowest CPU utilization of the five drives we looked at, which translates into the ability to do other work while the drive is moving data to your PC.

The Pioneer includes a 16-bit SCSI adapter from Acumatic and a SCSI cable. In addition, you get DOS and Windows 3.x drivers, utilities for the SCSI adapter, and an audio-CD-player program.

The bottom line is that the Pioneer drive performs as expected, and it provides reasonable value. But its design has been passed over by technological advances. Unless you need the convenience of the removable CD cartridge or the six-disk capacity, you'd better with another drive.

Smart and Friendly Inc.

Smart and Friendly CDJ 4008



Based on the Nakamichi four-disk, 8X engine, the Smart and Friendly CDJ 4008 stands out in this group because it includes the most powerful software of the bunch.

An external SCSI-2 device, the Smart and Friendly drive

handy utilities. The drive comes with Adaptec's EZ-SCSI Lite 4.0, drivers and utilities for DOS, Windows 3.x, and Windows 95, and a handy collection called CD PowerTools. The PowerTools program includes several extremely useful utilities: CD Librarian for building a database of your CDs; a utility for assigning drive letters in Windows 95; and an audio-CD-player utility.

If you want to share the drive on a network, you're covered as well. The drive comes with three different network applications, covering a range of LAN envi-



Smart and Friendly CDJ 4008
Street price: \$500
Smart and Friendly Inc
Chatsworth, CA
800-959-7001, 818-772-8001
www.smartandfriendly.com
Circle 415 on reader service card

POWER PROGRAMMING:

Smart and Friendly's CDJ 4008 came with the best assortment of CD changer software.

comes with a 16-bit ISA Adaptec SCSI adapter and cable. Windows 95 recognized the drive automatically, so you don't need the bundled software. But don't miss out on these

ronments and making it easier to manage CD-ROM access among multiple users.

In terms of performance, the Smart and Friendly turned in scores that were similar to the other Nakamichi-based models'. The CD-ROM WinMark score was 620 thousand Bps, and the average access time was 188 ms. The data transfer rate for 4K records was 1,290 thousand Bps, and the average time to swap a disk was 8.6 seconds.

At \$500, the Smart and Friendly CDJ 4008 is more expensive than most of its competitors, but the package includes an Adaptec SCSI adapter and a stack of software. If you need any of the local-network features, or if you simply want to be able to access the drive as a single drive letter, then it is a walk-away favorite in this five-drive race.

SUMMARY OF FEATURES

CD-ROM Changers: Side by Side



	Micro Design International SCSI Express Mini-Changer	Nakamichi America Corp. Nakamichi MJ-4.8s	Panasonic Computer Peripheral Co. Panasonic 10X Big 5	Pioneer New Media Technologies Inc. Pioneer DRM-624X	Smart and Friendly Inc. Smart and Friendly CDJ 4008
■ YES ■ NO					
Products listed in alphabetical order					
Price	\$895 (list)	\$400 (street)	\$250 (street)	\$330 (street)	\$500 (street)
Rated drive speed/Number of disks	8X, 4	8X, 4	10X, 5	4.4X, 6	8X, 4
Disk changer engine manufacturer	Nakamichi	Nakamichi	Panasonic	Pioneer	Nakamichi
Loading mechanism	Single slot	Single slot	Single slot with tray	Cartridge	Single slot
Internal buffer size/Interface	256K, SCSI-2	256K, SCSI-2	128K, ATAPI Mode 4	128K, SCSI-2	256K, SCSI-2
Headphone jack/Volume control	■ ■	■ ■	■ ■	■ ■	■ ■
Dimensions (HWD, in inches)	3.7 x 7.8 x 14.8	1.7 x 5.9 x 8.3*	1.7 x 5.9 x 8.3*	3.4 x 8.2 x 14.2	2.3 x 9.8 x 10.8
Warranty on parts and labor	1 year	1 year	2 years	1 year	1 year

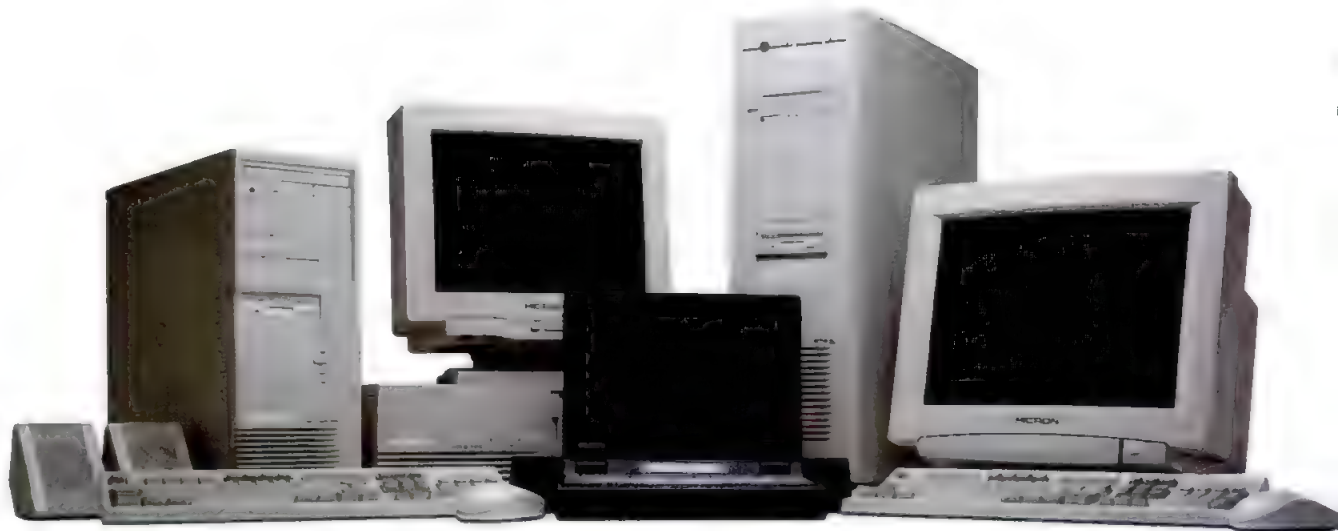
* This drive is an internal device.

THE REVIEWS ARE IN...

MICRON
ELECTRONICS, INC.

WE THINK YOU'LL AGREE

**Micron is the
superior choice.**



In the past year, Micron Electronics
has won nearly a hundred awards for
product performance, customer service
and support.

REVIEW A New Millennium

Micron's Millennium Pro
Flies High With 200MHz
Of Pentium Pro Power

37 Product Review



Comp. 3D CAD



SUPERIOR DESKTOP SOLUTIONS

Millennia™ P200

With Intel 133MHz Pentium processor
With Intel 166MHz Pentium processor

add \$100
add \$100

- Intel 200MHz Pentium® processor
- 512KB pipeline burst cache, flash BIOS
- 12X EIDE CD-ROM drive, 3.5" floppy drive
- 16-bit stereo sound & speakers
- PCI 64-bit 3D video, MPEG, 4MB EDO RAM
- Tool-free minitower or desktop
- Microsoft® Mouse, 104-key keyboard
- Microsoft Windows® 95 & MS® Plus! CD
- 5-year/3-year Micron Power warranty

- 16MB EDO RAM
- 1.6GB EIDE hard drive
- 15" Micron 15FGx, 28dp (13.7" display)
- Microsoft Works 95 CD

\$1,999
Bus. lease \$68/mo.

- 32MB EDO RAM
- 2.5GB EIDE hard drive
- 15" Micron 15FGx, 28dp (13.7" display)
- Microsoft Office Pro 95 & Bookshelf 95 CDs

\$2,299
Bus. lease \$78/mo.

- 64MB EDO RAM
- 3.1GB EIDE hard drive
- 17" Micron 17FGx, 26dp (15.8" display)
- Microsoft Office Pro 95 & Bookshelf 95 CDs

\$2,899
Bus. lease \$99/mo.

Millennia™ P200 Plus

With Intel 166MHz Pentium processor

add \$100

- Intel 200MHz Pentium processor
- 512KB pipeline burst cache, flash BIOS
- PCI 32-bit Ultra SCSI Fast-20 controller
- 12X SCSI CD-ROM drive, 3.5" floppy drive
- 16-bit stereo sound & speakers
- PCI 64-bit 3D video, MPEG, 4MB EDO RAM
- Tool-free minitower or desktop
- Microsoft Mouse, 104-key keyboard
- Microsoft Windows 95 & MS Plus! CD
- 5-year/3-year Micron Power warranty

- 16MB EDO RAM
- 2GB Ultra SCSI hard drive
- 15" Micron 15FGx, 28dp (13.7" display)
- Microsoft Works 95 CD

\$2,699
Bus. lease \$92/mo.

- 32MB EDO RAM
- 4GB Ultra SCSI hard drive
- 15" Micron 15FGx, 28dp (13.7" display)
- Microsoft Office Pro 95 & Bookshelf 95 CDs

\$3,199
Bus. lease \$109/mo.

- 64MB EDO RAM
- 9GB Fast SCSI-2 hard drive
- 17" Micron 17FGx, 26dp (15.8" display)
- Microsoft Office Pro 95 & Bookshelf 95 CDs

\$4,799
Bus. lease \$163/mo.

FAMILY MULTIMEDIA SOLUTIONS

Home MPC™ P133

With Intel 133MHz Pentium processor

add \$100

- Intel 133MHz Pentium® processor
- 512KB pipeline burst cache, flash BIOS
- 16MB EDO RAM
- 1.6GB EIDE hard drive
- 12X EIDE CD-ROM drive, 3.5" floppy drive
- 16-bit stereo sound & speakers
- 28.8 fax/modem, speakerphone, voice mail
- Microsoft® Phone telephony software
- Internet ready:
Free 1 month Spy® Internet access,
Microsoft Internet Explorer® 3.0
- Prodigy®, America Online® & CompuServe®
trial memberships
- PCI 64-bit 3D video, MPEG, 2MB EDO RAM

- 15" Micron 15FGx, 28dp (13.7" display)
- Tool-free minitower or desktop
- Microsoft Mouse, 104-key keyboard
- Microsoft Windows® 95 & MS® Plus! CD
- Quicken® Financial Pak includes: Quicken Deluxe 5.0, Quicken Financial Planner®, Quicken Parents' Guide to Money®, and Quicken Family Lawyer®
- Family Pak includes: ABC by Dr. Seuss, Thinkin' Things® Collection 1, Earthworm Jim® and MechWarrior® 2
- Microsoft Home Pak includes: Works 4.0, Publisher Deluxe, Encarta® Encyclopedia, Monster Truck Madness, CD sampler, plus more!
- 5-year/3-year Micron Power warranty

\$1,899

Home MPC™ P200

With Intel 166MHz Pentium processor

add \$100

- Intel 200MHz Pentium processor
- 512KB pipeline burst cache, flash BIOS
- 32MB EDO RAM
- 2.5GB EIDE hard drive
- 12X EIDE CD-ROM drive, 3.5" floppy drive
- 16-bit 3D Waveable stereo sound card
- Advent® AV270 2x25 watt stereo speakers
- 28.8 fax/modem, speakerphone, voice mail
- Microsoft Phone telephony software
- Internet ready:
Free 1 month Spy® Internet access,
Microsoft Internet Explorer® 3.0
- Prodigy®, America Online® & CompuServe®
trial memberships
- PCI 64-bit 3D video, MPEG, 2MB EDO RAM

- 17" Micron 17FGx, 26dp (15.8" display)
- Tool-free minitower or desktop
- Microsoft Mouse, 104-key keyboard
- Microsoft Windows 95 & MS Plus! CD
- Microsoft Office Pro 95 & Bookshelf 95 CDs
- Quicken Financial Pak includes: Quicken Deluxe 5.0, Quicken Financial Planner®, Quicken Parents' Guide to Money® and Quicken Family Lawyer
- Family Pak includes: ABC by Dr. Seuss, Thinkin' Things® Collection 1, Earthworm Jim and MechWarrior 2
- Microsoft Home Pak includes: Works 4.0, Publisher Deluxe, Encarta Encyclopedia, Monster Truck Madness, CD sampler, plus more!
- 5-year/3-year Micron Power warranty

\$2,899



A New Millennium

Micron's Millennium Pro
Flies High With 200MHz
Of Pentium Pro Power

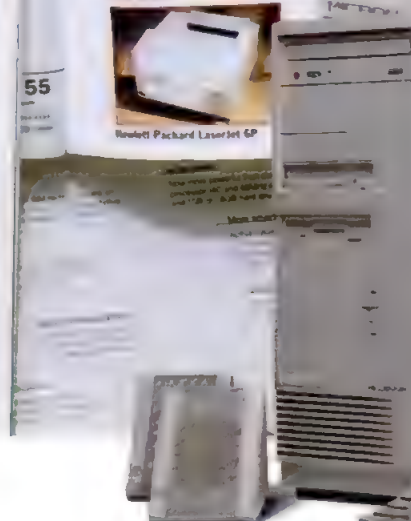
37 Products Reviewed



Carroll ID-6AD



HP LaserJet 6P



Outstanding Performance—Don't Take Our Word for It.

Talk is cheap when you're speaking for yourself. But when it's from the mouth of an industry expert, it carries weight. Here are a few of many examples of what they're saying about Micron PCs:

- | | | |
|------------------------------|---|---------------------------------|
| Micron Home MPC™ | <i>"... the fastest we've ever tested... as well as a marvelous family package... it wins our Top Rated award..."</i> | —Family PC, May 1996 |
| Micron Millennium™ | <i>"In short, Micron covers all the bases with this Best Buy"</i> | —PC World, March 1996 |
| Micron PowerServer™ | <i>"This is definitely a best buy"</i> | —Computer Shopper, January 1996 |
| Micron Millennium TransPort™ | <i>"...nearly a dead ringer for IBM's ThinkPad... but performs better and saves you about \$2,500."</i> | —PC Magazine, April 1996 |

The Right System for You

Micron makes a suite of outstanding solutions designed for the way you work or play. From home systems to servers, desktop PCs to portable multimedia solutions, Micron always comes through with a system built to satisfy. For details and prices, turn the page.

Micron Power™



Warranty & Support

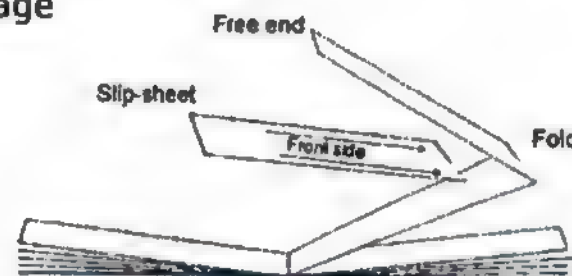
- 5-year limited warranty on microprocessor and main memory
- 3-year limited parts-only system warranty
- 1-, 2- or 3-year optional on-site service agreement for Micron desktop and server systems
- 30 days of free Micron-supplied software support for Micron desktop systems; 3 optional network operating system incident resolutions included for Micron server systems
- 30-day money-back policy
- 24-hour technical support

MICRON™
ELECTRONICS, INC.

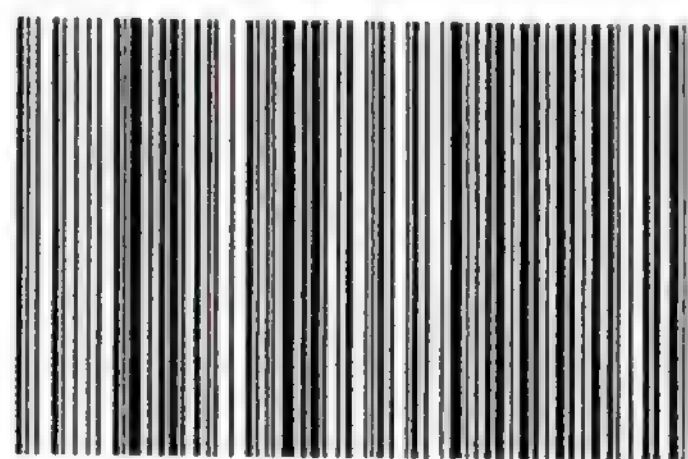
800-707-2329

<http://www.mei.micron.com>

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet



GbsSlipSheet-001

Inverted Foldout slip-sheet

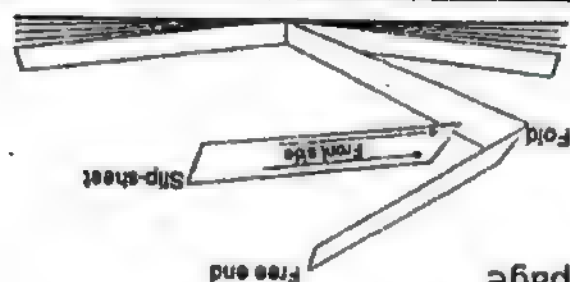
Folded edge of the page

1. Open the foldout page
2. Insert this sheet with

1. Front side touching the free page
2. Arrow pointing to the fold

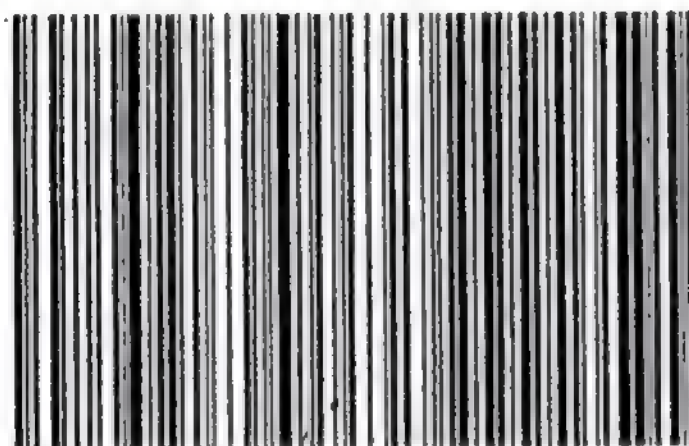
3. Slice the folded edge

4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



GbsShipBack-0018

Back

1. Follow instructions on the other side



DISCOVER FOR YOURSELF WHY MICRON KEEPS RECEIVING ACCLAIM.



Any PC maker can claim to offer a solution that covers your needs. But at Micron Electronics™, we prefer to let our history and our products speak for themselves. We think you'll agree it's an impressive story.

Superior Manufacturing—A Micron Tradition

Micron builds PCs with a legacy of excellence. Our manufacturing processes grew out of nearly two decades in the semiconductor business, where precision is measured in millionths of an inch, and quality in parts per million. We've built strategic relationships with companies like Intel, Microsoft and Novell. From this solid background, we're forging unbeatable systems you can count on today and tomorrow.

Award-Winning Products

In the past two years, leading industry publications have applauded Micron PCs with more than 170 awards for product performance, customer service and support. This includes *PC Magazine's* Best Products of 1995 and Editors' Choice awards in several categories. Add more than 40 *PC World* Best Buy awards and you've got an impressive technology hall of fame.

Recognized Service and Reliability

After your purchase, the story continues. Just ask *PC Magazine* readers. They bestowed on us the coveted Readers' Choice for Customer Service and Reliability in 1994 and 1995. And *PC World* recently awarded us first-tier status along with the likes of Apple, Compaq, Digital and HP. Pretty good company, wouldn't you say?

Micron Power™ Warranty—An Industry First

We support our reliability promise with the industry-leading Micron Power warranty. It backs the microprocessor and main memory for five years, an industry first. Add a three-year, parts-only system warranty and a 30-day money-back guarantee, and you can rest assured that you're in good hands.

SERVER SOLUTIONS

Vetix™ EL 1000N

With Sony 4/3GB DOS-2 SCSI DAT tape back-up drive add \$999
*Vetix EL 1000 and 2000 models available with Microsoft Windows NT Server. Call for pricing.

- Intel 200MHz Pentium® Pro processor
- Dual Pentium Pro ZIF sockets
- 256KB L2 cache, flash BIOS
- Memory upgradable to 512MB
- Slots: 1 ISA, 3 PCI, 1 shared PCI/ISA
- Adaptec® PCI 32-bit Ultra SCSI Fast-20 controller
- 12X SCSI-2 CD-ROM drive, 3.5" floppy drive
- 64-bit 1MB ISA video
- 3Com® 3C595 Fast EtherLink® PCI 10/100 NIC (RJ-45)
- Full-size tower with 10 drive bays
- 15" Micron 15FGx, .28dp (13.7" display)
- Microsoft® Mouse, 104-key keyboard
- Novell® NetWare® 4.X (5 user license)
- NOS support (3 resolutions)
- 5-year/3-year Micron Power® warranty

• 32MB ECC RAM
• 2GB Ultra SCSI hard drive

\$4,499
Bus. lease \$153/mo.

• 64MB ECC RAM
• 4GB Ultra SCSI hard drive

\$4,999
Bus. lease \$170/mo.

CORPORATE NETWORK SOLUTIONS

ClientPro™ P120

With Intel 133MHz Pentium processor add \$50

- Intel 120MHz Pentium® processor
- 256KB pipeline burst cache, flash BIOS
- 16MB EDO RAM
- 3Com® 3C509 ethernet ISA NIC (BNC, AUI & RJ-45)
- 3.5" floppy drive
- PCI 64-bit graphics accelerator, 2MB EDO RAM
- Tool-free minitower or desktop
- Microsoft® Mouse, 104-key keyboard
- MS-DOS® 6.22/Windows® for Workgroups 3.11
- Microsoft Works preinstalled
- 5-year/3-year Micron Power® warranty

• 1.2GB EIDE hard drive
• 14" Micron 14FGx, .28dp (12.9" display)

\$1,499
Bus. lease \$51/mo.

• 2.1GB EIDE hard drive
• 15" Micron 15FGx, .28dp (13.7" display)

\$1,699
Bus. lease \$58/mo.

Vetix™ EL 2000N

With Sony 4/3GB DOS-2 SCSI DAT tape back-up drive add \$999
*Vetix EL 1000 and 2000 models available with Microsoft Windows NT Server. Call for pricing.

- Dual Intel 200MHz Pentium Pro processors
- 256KB L2 cache, flash BIOS
- Memory upgradable to 512MB
- Slots: 1 ISA, 3 PCI, 1 shared PCI/ISA
- Adapter: PCI 32-bit Ultra SCSI Fast-20 controller
- 12X SCSI-2 CD-ROM drive • 3.5" floppy drive
- 64-bit 1MB ISA video
- 3Com 3C595 Fast EtherLink PCI 10/100 NIC (RJ-45)
- Full-size tower with 10 drive bays
- 15" Micron 15FGx, .28dp (13.7" display)
- Microsoft® Mouse, 104-key keyboard
- Novell NetWare 4.X (5 user license)
- NOS support (3 resolutions)
- 5-year/3-year Micron Power warranty

• 64MB ECC RAM
• 4GB Ultra SCSI hard drive

\$5,799
Bus. lease \$182/mo.

• 128MB ECC RAM
• 9GB Fast SCSI-2 hard drive

\$6,999
Bus. lease \$218/mo.

ClientPro™ 2 180

- Intel 180MHz Pentium® Pro processor
- 256KB internal cache, flash BIOS, DMI support
- 3Com 3C509 ethernet ISA NIC (BNC, AUI & RJ-45)
- PCI 64-bit graphics accelerator, 2MB EDO RAM
- 3.5" floppy drive
- Tool-free minitower or desktop
- Microsoft® Mouse, 104-key keyboard
- Microsoft Windows NT® Workstation 4.0
- 5-year/3-year Micron Power warranty

• 16MB EDO RAM
• 1.2GB EIDE hard drive
• 15" Micron 15FGx, .28dp (13.7" display)
• Microsoft Works preinstalled

\$1,999
Bus. lease \$68/mo.

• 32MB EDO RAM
• 2.1GB EIDE hard drive
• 15" Micron 15FGx, .28dp (13.7" display)
• Microsoft Office Pro 95

\$2,299
Bus. lease \$78/mo.

• 32MB EDO RAM
• 3.1GB EIDE hard drive
• 17" Micron 17FGx, .26dp (15.8" display)
• Microsoft Office Pro 95

\$2,599
Bus. lease \$88/mo.

HIGH-PERFORMANCE SOLUTIONS

Millennia™ Pro2 180

With 2nd Intel 180MHz Pentium Pro processor add \$199
With Microsoft Windows NT Workstation 4.0 CD add \$99
*Second processor requires Microsoft Windows NT Workstation 4.0

- Intel 180MHz Pentium® Pro processor
- Supports dual Intel 180MHz Pentium Pro processors
- 256KB internal cache, flash BIOS
- 12X EIDE CD-ROM drive, 3.5" floppy drive
- 16-bit stereo sound & speakers
- PCI 64-bit 3D video, MPEG, 4MB EDO RAM
- Tool-free minitower or desktop
- Microsoft® Mouse, 104-key keyboard
- Microsoft Windows® 95 & MS® Plus! CD
- 5-year/3-year Micron Power® warranty

• 16MB EDO RAM
• 2.5GB EIDE hard drive
• 15" Micron 15FGx, .28dp (13.7" display)
• Microsoft Works 95 CD

\$2,199
Bus. lease \$75/mo.

• 32MB EDO RAM
• 3.1GB EIDE hard drive
• 17" Micron 17FGx, .26dp (15.8" display)
• Microsoft Office Pro 95 & Bookshelf® 95 CDs

\$2,699
Bus. lease \$92/mo.

Millennia™ Pro2 360 Plus

- Dual Intel 180MHz Pentium Pro processors
- 256KB internal cache, flash BIOS
- PCI 32-bit Ultra SCSI Fast-20 controller
- 12X SCSI CD-ROM drive, 3.5" floppy drive
- 16-bit stereo sound & speakers
- PCI 64-bit 3D video, MPEG, 4MB EDO RAM
- Tool-free minitower or desktop
- Microsoft Mouse, 104-key keyboard
- Microsoft Windows NT® Workstation 4.0 CD
- Microsoft Office Pro 95 & Bookshelf® 95 CDs
- 5-year/3-year Micron Power warranty

• 32MB EDO RAM
• 2GB Ultra SCSI hard drive
• 15" Micron 15FGx, .28dp (13.7" display)

\$3,699
Bus. lease \$126/mo.

• 64MB EDO RAM
• 4GB Ultra SCSI hard drive
• 17" Micron 17FGx, .26dp (15.8" display)

\$4,549
Bus. lease \$155/mo.

• 128MB EDO RAM
• 9GB Fast SCSI-2 hard drive
• 21" Micron 21FGx, .26dp (20.0" display)

\$6,799
Bus. lease \$214/mo.

PORTABLE SOLUTIONS

Millennia™ TransPort™

- Mobile Intel Pentium® processor
- Intel 430MX PCI chipset
- 256KB L2 pipeline burst cache
- 8X modular CD-ROM drive
- PCI graphics accelerator, 1MB EDO RAM
- Pick-a-Point™ dual pointing devices integrate both pointing stick and touchpad
- Removable EIDE hard drive
- 3.5" modular floppy drive
- Intelligent modular lithium-ion battery
- 16-bit stereo sound
- Built-in stereo speakers and microphone

- 2 Type II or one Type III PCMCIA slots
- S-video and NTSC-video outputs
- Headphone, microphone and line-in jacks
- 2 infrared ports, one front, one back
- Parallel, serial, VGA and 2 PS/2® ports
- Dimensions: 11.7" x 9.4" x 2.0", weight: 6.9 lbs.†
- Nylon carrying case
- Microsoft® Windows® 95 and MS® Plus! CDs
- Microsoft Office Pro 95 and Bookshelf® 95 CDs
- Kensington™ security lock ready‡
- 5-year/3-year Micron Power™ warranty

† 4.9 lbs. includes 3.5" floppy and one battery.
‡ Lock secures both Millennia TransPort and MicroDoc

- 133MHz mobile Intel Pentium processor
- 32MB EDO RAM (48MB max.)
- 12.1" active matrix color display, 800x600
- 1.3GB removable hard drive

\$4,099
Bus. lease \$139/mo.

- 133MHz mobile Intel Pentium processor
- 32MB EDO RAM (48MB max.)
- 12.1" active matrix color display, 800x600
- 2.1GB removable hard drive
- Motorola® Montana 33.6 fax/modem
- 2nd lithium-ion battery

\$4,599
Bus. lease \$156/mo.

OPTIONS

- With 16MB DIMM module upgrade add \$349
- With 33.6 fax/modem add \$259
- With 2nd lithium-ion battery add \$199
- With primary 2.1GB hard drive upgrade add \$100
- With MicronDock™ multimedia port replicator add \$299
- With MicronExec™ desktop package add \$799
- With car adaptor add \$89



• 900 E. Karcher Road, Nampa, ID 83687
• Mon-Fri 9am-10pm Sat 7am-5pm (MT)
• International Sales Hours: Mon-Fri 6am-7pm (MT)
• Phone: 208-893-3434 • Fax: 208-893-3424
• Purchase Order Fax: 208-893-8992
• GSA Contract #GS35F4317D

• Technical Support Available 24 Hours A Day—7 Days A Week
• Technical Support Phone: 888-FIX-MYPC
• Technical Support E-mail: techsupport.mei@micron.com



PENTIUM PRO
PROCESSOR



PENTIUM
PROCESSOR

MICRON
ELECTRONICS, INC.

800-707-2329

<http://www.mei.micron.com>

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Tollfree from Puerto Rico 800-708-1756

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Make a Great PC Even Better!

Custom configure your new Micron Electronics system with these popular options.

Multimedia Options

- 16-bit 3D Waveable stereo sound.....\$59*
- 16-bit 3D Waveable stereo soundcard w/2MB RAM.....\$99*
- Advent® AV270 Powered Partners® stereo speakers.....\$99
- Advent® AV370 Powered Partners stereo speakers w/subwoofer.....\$199
- Microsoft® SideWinder™ 3D Pro joystick.....\$59

Storage/Media Options

- Adaptec® 2940U Ultra SCSI Fast-20 controller.....\$100
(upgrade from system with standard Ultra SCSI Fast-20 controller)
- Plextor™ 12Plex 12X 1.8MB/sec SCSI internal CD-ROM drive
(upgrade from systems with standard 12X EIDE CD-ROM drive).....\$200**
- Iomega® Jaz™ SCSI drive with 1.0GB removable cartridge.....\$399**
- Iomega Zip™ IDE drive with 100MB removable cartridge.....\$99
- Iomega 6-pak of 100MB Zip cartridges.....\$99
- Iomega Dito™ 800 (400/800MB) Travan™ tape backup w/tape.....\$149
- Iomega Dito 3200 (1.6/3.2GB) Travan tape backup w/tape.....\$199
- Sony® 4/8GB SCSI DDS-2 DAT tape backup w/tape.....\$999**

Communications Options

- 33.6kb V.34 internal data/fax modem.....\$139***
- 28.8kb V.34 internal telephony data/fax modem w/full duplex speakerphone and voice mail.....\$159***

Networking Options

- 3Com® 3C509 ethernet ISA NIC (BNC, AUI & RJ-45).....\$99
- 3Com 3C595 Fast EtherLink® PCI 10/100 NIC (RJ-45 only).....\$159
- SMC® ISA TokenCard network card.....\$199

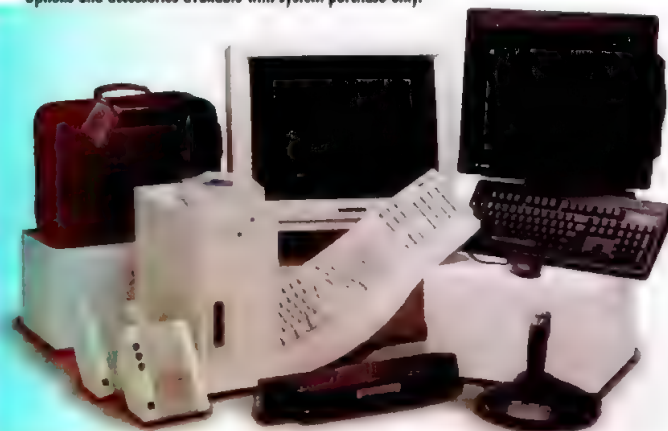
Quicken® Financial Pak

- Quicken Financial Pak, including: Quicken Deluxe 5.0; Quicken Financial Planner™; Quicken Parents' Guide to Money™; Quicken Family Lawyer™, (includes free TurboTax® offer).....\$79
(available only on desktop systems with Windows 95)

HP Printer Options

- HP DeskJet 680c printer—low-cost color printing for the home, complete with cable.....\$319
- HP DeskJet 870Cxi printer—fast color printing for the office, complete with cable.....\$519
- HP LaserJet SL-P5 printer—affordable B&W printing, complete with cable.....\$499

Options and accessories available with system purchase only.



EdVenture Pak

- EdVenture Pak, including: Sheila Ray, the Brave; Puff-Puff® Saves the Zoo™; Reader Rabbit's Reading Development Library™ 1; Freddy Fish™ and the Case of the Missing Kelp Seeds™; and the Thinkin' Things™ Collection 2.....\$69
(available only on desktop systems with Windows® 95)

Display/Video Options

- 17" Hitachi® SuperScan® 1711 (15.9" display) 26dp color monitor.....\$150 ††
- 21" Hitachi SuperScan 2111 (20" display) 26dp color monitor.....\$650 ††
- Number Nine® Imagine™ 128 series II video card w/4MB VRAM.....\$500 †††
- Number Nine Imagine 128 series I video card w/8MB VRAM.....\$750 †††

Millennia TransPort™ Options

- MicronDock™ multimedia port replicator: ethernet 10BT LAN adapter, SCSI-2 port, S-video and NTSC-video output, built-in stereo speakers, infrared port, headphone, microphone, line-in jacks, parallel, serial, VGA and 2 PS/2® ports.....\$299
- MicronExec™ desktop package: matching black 17" monitor (15.8" display) with matching black mouse, mousepad and keyboard (can be used with or without MicronDock).....\$799
- Motorola® Montana 36.6 fax/modem supports regular telephone connections, cellular phones and two-way paging devices.....\$259
- 3Com ethernet 10BT PCMCIA.....\$149
- Samsonite® leather bag.....\$99
- 2nd modular Lithium-Ion battery.....\$199
- 2nd hard drive (1.3GB).....\$599
- 2nd hard drive (2.1GB).....\$699
- 16MB DIMM upgrade.....\$349
- Car adapter.....\$89

Service Options

- Extended 2-year on-site service coverage for desktop systems
(upgrade from optional 1-year on-site service coverage).....\$99
- Extended 3-year on-site service coverage for desktop systems
(upgrade from optional 1-year on-site service coverage).....\$139
- Complete on-site PC installation (call Micron Electronics for details).....\$159

Other Options

- APC® Pro7T surge suppressor.....\$39
- APC Pro7T surge suppressor.....\$59
- Microsoft Natural Keyboard®.....\$49
(upgrade from standard keyboard)

* Upgrade from systems with standard 16-bit stereo sound card

** Requires SCSI host adapter

*** V.34 modem includes trial memberships to CompuServe®, Prodigy® and America Online®

† Requires sound card

†† Upgrade from systems with standard Micron 17" 17FGx color monitor

††† Upgrade from systems with standard 64-bit 2MB video card

CIRCLE 370 ON READER SERVICE CARD OR GO TO WWW.PCMAG.COM/ProductLink

MICRON
ELECTRONICS, INC.

800-707-2329

<http://www.mei.micron.com>



The ultra-value Pentium® processor-based PC.

- Intel® 100, 120 or 133 MHz Pentium processor
- 8 or 16MB RAM standard, expandable to 192MB
- EDO RAM
- 256KB burst synchronous cache
- 1080MB** high-performance Enhanced-IDE hard drive
- 64-bit PCI integrated graphics accelerator with 1 or 2MB video RAM software selectable
- Flash BIOS for easy upgrade
- Windows® 95
- Preloaded HP DMI Desktop Management Interface
- Free three-year limited warranty for parts and labor¹

from **\$1,110***



HP Vectra VE

Leading Pentium processor/PCI performance at an affordable price.

- Intel 100, 120, 133, 150, 166 or 200 MHz Pentium processor
- Desktop and minitower packages
- 256KB burst synchronous cache
- 8-16MB EDO RAM, expandable to 128MB
- PCI/ISA architecture
- 1280MB** high-performance Enhanced-IDE hard drive
- PCI integrated graphics accelerator and 1MB DRAM standard, upgradable to 2MB or Matrox Millenium PCI graphics card with 3D acceleration and 2MB WRAM, upgradable to 8MB
- Flash BIOS for easy upgrade
- Full plug-and-play capability
- Windows 95
- Preloaded HP DMI Desktop Management Interface
- Free three-year limited warranty for parts and labor¹

from **\$1,316***



HP Vectra VL

The most powerful value PC for advanced users and 32-bit applications.

- Intel Pentium Pro 180 or 200 MHz processor with 256KB integrated cache
- Choice of desktop or minitower
- 16 or 32MB EDO RAM, expandable to 192MB
- PCI/ISA system architecture
- 64-bit PCI integrated graphic accelerator or Matrox Millenium graphics card on minitowers
- 1.2 or 2.5GB Enhanced-IDE hard drive
- 3 available PCI slots for maximum expansion
- 8X CD-ROM on most models
- Flash BIOS for easy upgrade
- Windows 95 or Windows NT® 3.51 with free upgrade to Windows NT 4.0
- Windows 95 and Windows NT Soft Power Down
- Free three-year limited warranty for parts and labor¹

from **\$2,419***



HP Vectra VA

**The best combination of
performance, manageability
and networking.**

- Intel Pentium Pro 180 or 200 MHz processor with 256KB integrated cache
- 16 or 32MB EDO RAM, expandable to 192MB
- PCI/ISA system architecture
- High-performance Matrox Millennium PCI graphics card with 2MB upgradable to 4 and 8MB
- 1.2 or 2.5GB Enhanced-IDE hard drive
- Integrated audio with ergonomic volume control and built-in speaker
- 8X CD-ROM
- Integrated Ethernet 10Base-T controller
- LAN remote Power ON
- Flash BIOS for easy upgrade
- Windows NT 3.51 with free upgrade to Windows NT 4.0
- Windows NT Soft Power Down
- Free three-year limited warranty for parts and labor¹

from **\$2,696***



HP Vectra XA

The ultimate PC.

- Intel Pentium Pro 180 or 200 MHz processor with 256KB integrated cache
- Supports dual processing with secondary Pentium Pro processor socket
- 128-bit high-performance memory architecture
- 32MB ECC DIMM memory standard, expandable to 512MB with 8 DIMM memory expansion slots
- PCI integrated Ultra SCSI Fast 20 interface with 20MB/s throughput
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First Looks

PDAs

Windows in Your Palm

Microsoft's compact Windows CE could breathe new life into the moribund PDA market.—By Sebastian Rupley

The svelte, new operating system, Microsoft Windows CE, is here, and it may just wake up the sleepy market for PDAs by providing a level playing field for both hardware and software vendors. Originally code-named Pegasus, Windows CE serves up the standard Windows interface in a compact format for hand-held PCs, digital pagers, and smart cellular phones. Beyond that, the ultimate goal is for Windows CE to enable a new generation of entertainment and multimedia devices.

Basically, Windows CE is an instant-on 32-bit, multitasking, and multithreaded OS for palmtop computers. All items are displayed on the system's stylus-enabled 480- by 240-pixel screen that can show four levels of gray scale. The OS provides enough of an open architecture to allow third parties to furnish a variety of devices and programs to run on them.

CONDENSED WINDOWS SOUP

To accommodate the limited memory configurations of hand-held devices, Windows CE is compact. Most of the first wave of Windows CE palmtops will include 2MB of RAM and 4MB of ROM (both upgradable).

Windows CE can accommodate multiple processors, but the first generation of palmtops based on the operating system will use single 32-bit RISC CPUs from Hitachi, NEC, and Philips. Because every watt counts, Windows CE has integrated power management. We anticipate that most of the hand-held PCs based on it will run for up to 50 hours on a pair of AA batteries.

Communications functionality built into Windows CE enables access to the Internet for sending and receiving e-mail or

browsing the Web. Hardware and communications support is built into the OS, so a host of PC Card and other hardware accessories works with Windows CE

are feature-limited interpretations of their desktop namesakes. For example, Pocket Excel was a subset of the built-in mathematical functions, but it lacks Excel's extensive graphing capabilities, which are standard fare on the spreadsheets used by the Sharp-Zaurus and the Psion 3c.

Windows CE also comes with Microsoft's Internet Explorer, although its functions more closely match those of Version 2.0 than the current 3.0 program. During

scratches when a stylus is used.

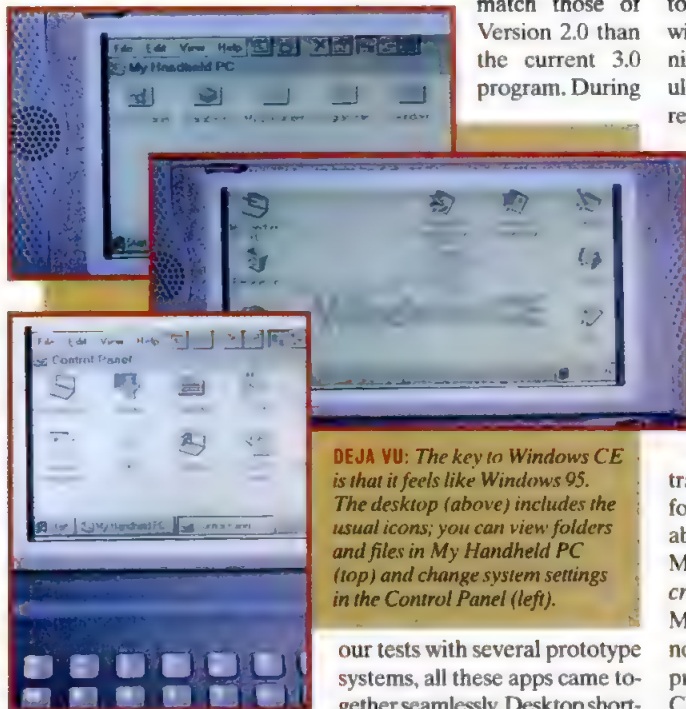
More useful on a day-to-day basis is the Power icon within the Control Panel, which reports on the status of the built-in backup battery and the AA batteries. Finally, under the Display portion of the Control Panel, the user can adjust image and contrast to make the small screen more readable.

The first Windows CE palmtops will support IrDA infrared wireless printing and file synchronization. A Communicate module includes PC Link software, remote-control applications, and the familiar Terminal application. Windows CE recognized several PC Card modems on our tests.

DEVELOPERS WANTED

Although Windows CE will get a boost from the pocket versions of such Microsoft applications as Word and Excel, the operating system's success depends on attracting others to write software for the platform. There's a list of about 20 software developers on Microsoft's Web site (www.microsoft.com), including Green Mountain software, Puma Technology, and Symantec, that have promised to provide Windows CE products.

Unlike other compact operating systems for hand-held PCs, such as General Magic's Magic Cap or Apple's Newton 2.0, Windows CE is not positioned as aggressively for communications, e-mail, and messaging. Rather, it represents a bet by Microsoft that users value standard productivity-focused Windows applications and file-transfer synchronization with their desktop counterparts. More than Windows-lite, Windows CE is a go-anywhere operating system for data that just can't stay put. **Microsoft Windows CE. Requires:** 2MB RAM, 2MB ROM. Microsoft Corp., Redmond, WA; 800-426-9400, 206-882-8080; www.microsoft.com. **Circle 410** on reader service card.



DEJA VU: The key to Windows CE is that it feels like Windows 95. The desktop (above) includes the usual icons; you can view folders and files in My Handheld PC (top) and change system settings in the Control Panel (left).

on a plug-and-play basis.

For most, Windows CE will look and feel like a slimmed-down version of what's on their desktop. They'll be greeted by the familiar Windows graphical interface, right down to the Start button, Windows Explorer, a Recycle bin, a Documents view available from the Start menu, and the Control Panel.

Like other Windows operating systems, Windows CE will come with an assortment of applets, including a calendar, a contacts file, an in-box for e-mail (the operating system supports Microsoft Exchange), and a to-do list module.

For more heavy-duty tasks, look for streamlined versions of Microsoft Excel and Word. Both

our tests with several prototype systems, all these apps came together seamlessly. Desktop shortcuts and folders even worked within Windows CE exactly as they did in Windows 95.

The development environment for Windows CE includes a collection of Win32 APIs common to other members of the Windows family. Microsoft expects a wide variety of Windows applications to be ported to Windows CE.

Windows CE also includes some functionality to make portable computing more tolerable. For example, the Control Panel allowed us to adjust how the operating system responds to input from a stylus. We tried a number of different settings, including a sound-level control, which can mute or amplify audible clicks and

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First Looks

OPTICAL STORAGE

Heavy Data Hauler

After a lengthy gestation period, Pinnacle Micro's MO drive, the Apex 4.6 GB, is born.—By Alfred Poor

After a year and a half of extra work, Pinnacle Micro has finally released the Apex 4.6 GB, a \$1,895 internal drive capable of squeezing 4.6GB onto a two-sided optical disk. With performance that is significantly slower than that of a system's native hard disk, the Apex excels where portability and high capacity are valued over speed.

The Apex picks up where Pinnacle Micro's Vertex, a 2.6GB optical drive, left off. The 5.25-inch media resides in a plastic cartridge; because it conforms to the 2.6GB ISO standard, it is compatible with other drives. Pinnacle Micro engineers were able to increase the disk capacity by using the inner and outer edges of the platters.

INNIE AND OUTIE

In order to use the inner tracks of a disk, the drive uses a smaller read/write head, which can come closer to the drive spindle. In addition to allowing greater capacity, the new type of head—which is lighter than its predecessors—can move more quickly and thus reduces seek times.

A new method of writing data to the disk reduces the spaces on the disk between the data pits and the tracks. This approach lets you record more information in one area.

The Apex is a mix of old and new: It uses traditional, two-pass writes, but it is based on magneto-optical (MO) technology. In this method, a laser heats the disk's data layer so that the magnetic write head can change the magnetic field for that data bit. The first pass erases the old

data, and the second pass writes the new information. Pinnacle Micro's next step may be to incorporate



LIM-DOW technology (light intensity modulation—direct overwrite) for single-pass writes, to speed the drive's operation.

Setup and installation of the unit were fairly straightforward. Microsoft Windows 95 immediately recognized the device without needing a driver disk. The drive has a pair of high-density SCSI connectors and two digital configuration switches on the back—one switch for the SCSI ID and the other for configuration settings. These settings let you determine SCSI termination, so you don't need to use a terminating plug if the drive is at the end of the SCSI chain. They also let you decide whether the drive performs a verification read pass after each write pass.

This 8.4- by 10.6- by 2.9-inch external drive weighs nearly 7 pounds. You can set it up either horizontally or vertically, but you can read the backlit LCD status screen only when the drive is horizontal. The front of

the drive also has LED indicators for power, the presence of media, and data-transfer activity. The only control on the front panel is a button for loading or ejecting the cartridge.

The Apex comes ready to go with an Adaptec 16-bit SCSI card and Adaptec's EZ-SCSI 4.0L, a utility software package you can use to partition and format the cartridges. Expect to receive an unformatted disk that should take about 40 minutes to format.

We tested the drive using our WinBench 97 benchmark tests on a 133-MHz Pentium PC, em-

SEEING THE LIGHT: Using the latest in magneto-optical technology, Pinnacle Micro's Apex sets the storage standard.

ploying an Adaptec PCI-bus SCSI card instead of the included ISA card. The device managed a Business Disk WinMark score of 281 thousands bytes per second (Bps) with the unit's verify-write feature enabled. The scores for 4K records were 1,830 thousand Bps for sequential reads and 797 thousand Bps for sequential writes.

With the verify-write feature disabled, the unit realized a 25 percent performance boost on 4K sequential writes to a score of 1,030, but the overall Business Disk WinMark score rose to only 314 (both scores in thousands of bytes per second).

The Apex is fast, but it is not

going to replace hard disks for general-purpose use. For example, our test-bed system's Conner 2.1GB hard disk turned in a Business Disk WinMark score of 684, twice as high as the Apex's. But the most important point is that although the Apex is slower than hard disks, it is as fast as some other MO drives—even those that have implemented one-pass writes using LIM-DOW technology, such as the Hitachi OU172.

CHEAP TO KEEP

The blank media lists for just \$169, which is less than 4 cents per megabyte. Compared with even the best price for a hard disk, this is a stunningly low figure.

And compared with the prices of other removable media, it is still attractive. With regard to features, our biggest problem with this otherwise brilliant piece of engineering is that you have to flip over the cartridge to access its full 4.6GB capacity.

Apex has proved to be worth the wait. It defines the cutting edge of magneto-optical storage for a wide range of applications whose users need large amounts of online, random-access data storage.

Apex 4.6 GB. List price: With drive, media cartridge, Adaptec SCSI card, \$1,895. Pinnacle Micro, Irvine, CA; 800-553-7070, 714-789-3000; www.pinnaclemicro.com. Circle 405 on reader service card.

BENCHMARK TESTS

Pinnacle Micro Apex 4.6 GB

The Apex 4.6 GB lagged behind our test-bed's Conner 2.1GB hard disk on the Business Disk WinMark 97 test; the Conner hard disk was more than twice as fast as the Apex. We used a Micron Millennia P/133 (a Pentium/133 PC) with 16MB of RAM, running Microsoft Windows 95.

Business Disk WinMark 97 Thousands of bytes per second		
Pinnacle Micro Apex 4.6 GB	281	
Conner 2.1GB hard disk	684	
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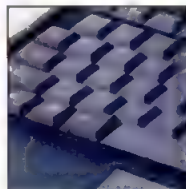
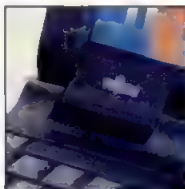
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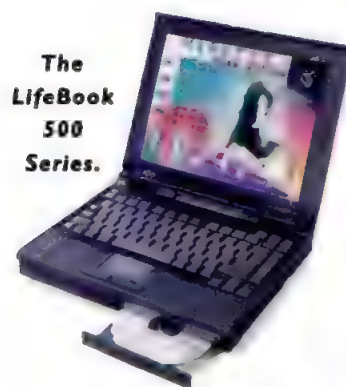
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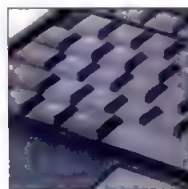
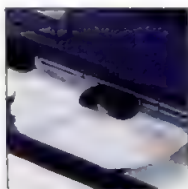


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First Looks

REMOTE CONTROL

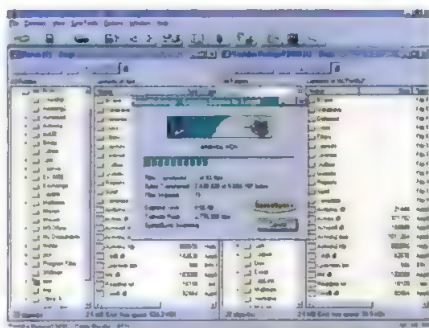
LapLink Keeps In Touch

Version 7.5 cements Traveling Software's hold on file transfer and remote control.—By Bruce Brown

Traveling Software's LapLink for Windows 95, Version 7.5 makes a good thing better by adding a powerful file-transfer automation function and improved remote-control features. Combine these additions with faster file-transfer speeds and the LapLink (\$150) should maintain its lock on the file-transfer and remote-control utility market.

This package includes a 32-bit Microsoft Windows 95 version of LapLink as well as a 16-bit edition for Windows 3.x. Also included is an 8-foot parallel-port transfer cable. LapLink doesn't limit you to connections with other computers via cable though. You can hook up to share files or remotely control other computers via a modem, a wireless connection, local or remote dial-up networks, or the Internet.

The most significant new fea-



FAST FILE TRANSFERS: LapLink's SpeedSync technology automatically detects and copies only those parts of files that need updating.

ture of Version 7.5 is the Xchange Agent. With it, you can select files and directories on each connected computer for regular synchronization and save the settings. For example, you can save different Xchange Agent files for daily or weekly transfers, or save them based on specific file types.

Once connected with another PC, LapLink lets you view the directory windows of both computers. After highlighting directories or files, you select the copy command to move them quickly.

LapLink's synchronization feature lets you update both systems simultaneously. Like its competitors—Symantec's pcAnywhere and Stac Electronics' Editors' Choice-winning ReachOut ("Friendly Takeovers," August 1996)—LapLink can speed updates by copying only the changed portions of files.

With two notebook computers connected via a standard parallel cable, it took 2 minutes to transfer 7.5MB of data from an ACT! 2.0 database. After adding a single record to the database on the source computer, we transferred the same files again. This time it took only 22 seconds,

because LapLink's SpeedSync feature skips unchanged files.

LapLink's remote-control feature is updated in the new version with display color-mode control and screen-objects caching, both of which speed operations. During testing, there was only a slight delay in running programs on the remote computer, and both screens were current at all times. If you only need to transfer files between computers occasionally, there are less expensive utilities, such as TouchStone Software's FastMove!.

But if you want a comprehensive file-transfer and remote-access program that is easy to use and offers solid performance, get behind the wheel of LapLink.

LapLink for Windows 95, Version 7.5. Street price: \$150. Requires: 8MB RAM, 7MB hard disk space, Microsoft Windows 3.1 or later, or Windows 95. Traveling Software Inc., Bothell, WA; 800-343-8080, 206-483-8088; www.travsoft.com. Circle 408 on reader service card.

WEB UTILITIES

Look, Ma! No Browser

Java-based Castanet Tuner delivers content from the Web to your desktop, without a browser.—By Scot Finnie

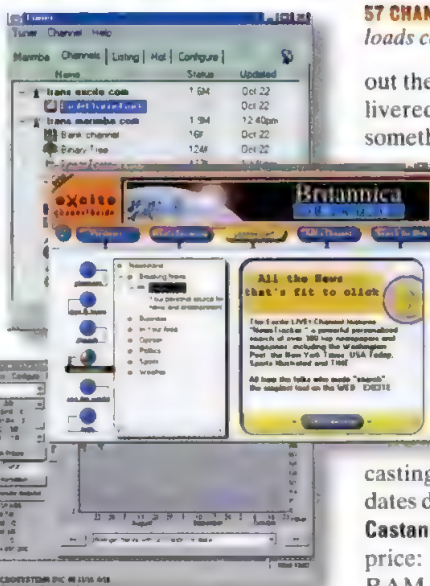
What do you get when you merge Java with up-to-the-minute Internet-content delivery? Marimba's free Castanet Tuner uses an intriguing new concept for delivering information over the Net. Java applets that run locally on your PC contain content and automatically update in the background.

That concept, known in Marimba patois as channels, represents a new level of functionality for Java on the Internet. Armed with the Castanet Transmitter server (\$995), Java developers can create and publish content-updating applets

that run locally on Castanet clients, which don't need a browser. The applets offer far richer functionality than typical Web pages.

At press time, the list of Castanet channel providers included DimensionX, EarthWeb's Gamelan, Excite!, Hot-Wired, and Stanford University. Many of the providers offer six or more channels, with such offerings as live news, stock tickers, loan calculators, 3-D games, and Web sites as applets.

Testing Castanet Tuner was at times frustrating because of



57 CHANNELS: Castanet downloads content from channels.

out the kinks, Java applets delivered this way can offer something that would rival the

Web itself. Still, Castanet has a way to go before its content can match the offerings of other broadcast models, such as the popular Point-Cast Network.

Still, Castanet offers a top-notch method for broadcasting and automatically updates digital information.

Castanet Tuner, Version 2. List price: Free. Requires: 16MB RAM, 5MB hard disk space, Microsoft Windows 95 or Windows NT 4.0. Marimba Inc., Palo Alto, CA; 415-328-5282; www.marimba.com. Circle 407 on reader service card.

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First Looks

AUDIO

The Only Speakers You'll Ever Need

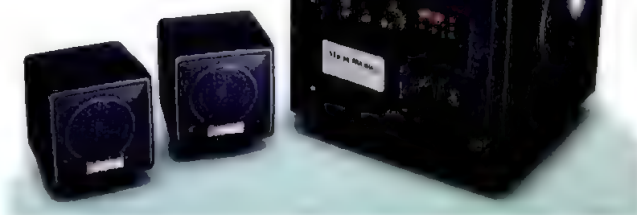
The MicroWorks system offers high-quality stereo sound for the price of PC speakers.—By Steve Buehler

The line between quality sound-system speakers and PC multimedia speakers is about to vanish thanks to the MicroWorks system, from Cambridge SoundWorks. These \$349 multimedia speakers are equally at home as high-end PC speakers or as room-filling stereo speakers.

The MicroWorks is similar to Cambridge's SoundWorks, a three-piece set ("Speakers: The Sound and the Fury," January 9, 1996). It takes up about the same amount of space but comes with a significantly more powerful amplifier. The SoundWorks' 4-watt satellite speakers and 10-watt subwoofer sound like weaklings compared with the MicroWorks' 12-watt satellites and 42-watt subwoofer.

Inside the MicroWorks' 17.5-by-9-by-8-inch subwoofer, a smoother bass port delivers a cleaner sound and eliminates the "chuffing" sound often found in small and midrange bass speaker boxes. And low-frequency reverberations—often heard as buzzing inside the bass box—are reduced with cleaner airflow. The 6.5-inch bass-speaker cone handles frequencies below 150 Hz, while the 4-inch cube satellite speakers handle mid-level and high ranges with surprising power. The result is coverage of the hearing range from 10 Hz to 20 kHz.

In last year's roundup of PC speakers, we were impressed with the sound quality of the SoundWorks system but disappointed by how difficult it was to



POWERFUL TRIO: The MicroWorks packs a lot more audio power into its three boxes: a subwoofer (right) and a pair of satellite speakers.

set up. By contrast, we had no problems getting the MicroWorks system up and running.

We tested the speakers both as a room system and up close as a near-field PC setup. In both cases, the MicroWorks earned excellent ratings. Low ranges were extremely clear and quite powerful; the subwoofer's 99-dB maximum gain produces a lot of sound. The satellites produced clear and accurate sound, although ex-

tremely high frequencies were somewhat harsh when compared with the slightly warm midrange output.

At ZD Labs, the MicroWorks exhibited both excellent frequency response (10 Hz to more than 20 kHz, plus or minus 6 dB) and excellent harmonic distortion (0.5 percent THD for the satellites and 1.1 percent THD for the subwoofer) on our Audio Precision AP-1 test-bed. Although the MicroWorks has no 3-D circuitry built in—as does SRS—it provided an excellent listening experience across all music types and CD game sound tracks. This is an indication of Cambridge's extensive hi-fi background and its reputation for products that deliver clear and accurate sound.

The MicroWorks is designed to compete with high-end PC and stereo-system speakers, such as the \$700 Bose Acoustimass system. Cambridge packs most of the same sound into a similar-size box, for half the price. The MicroWorks system is available only through the Cambridge catalog or company stores in New England and California, but if you're looking for excellent sound at a good price, the MicroWorks is worth looking at and listening to.

MicroWorks. List price: \$349. Cambridge SoundWorks, Newton, MA; 800-367-4434, 617-332-5936; www.hifi.com. Circle 402 on reader service card.

PERFORMANCE TESTS

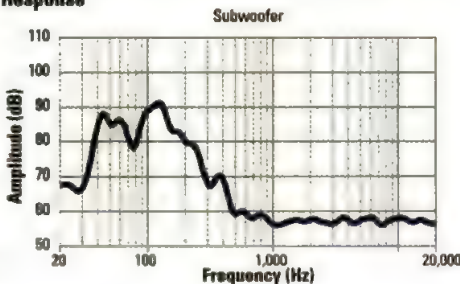
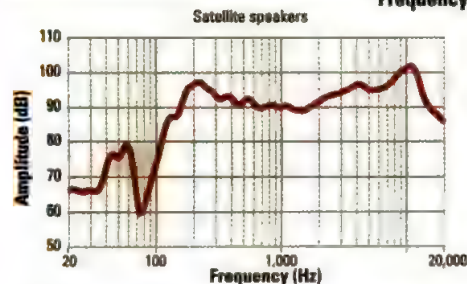
Cambridge MicroWorks



Cambridge MicroWorks is equally adept as part of a room system and in a near-field setup, such as a desktop PC. In both cases, the MicroWorks exhibited excellent performance—a nearly flat frequency response from 20 Hz to 20 kHz (plus or minus 6 dB) and total harmonic distortion (THD) of 0.5 percent for the satellites

and 1.1 percent for the subwoofer. We tested using an Audio Precision System One signal analyzer in a semianechoic chamber with a Brüel & Kjær 4007 microphone at a measuring distance of half a meter. We used Audio Precision's Maximum Length Sequence methodology to gauge frequency response and a five-tone test signal to measure THD.

Frequency Response



Total Harmonic Distortion

Percent	Satellite speakers	Subwoofer
Cambridge MicroWorks	0.5	1.1
Average speakers (1/9/96)	0.8	4.0

◀ BETTER

◀ BETTER

Making MIDI Sing

If the sound quality you're getting from MIDI files embedded on Web pages doesn't exactly thrill you, jump over to Yamaha's site (www.yamaha.com) and download a free beta version of MIDPlug. A helper app for Netscape, Version 2.01 or later, MIDPlug is a soft synthesizer that brings wavetable quality to the rendering of embedded MIDI.

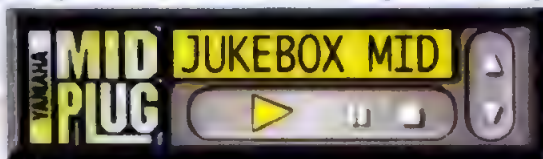
Regardless of whether you have an FM synthesis or wavetable audio card, MIDPlug can improve the quality of what you hear. MIDPlug also supports the majority of XG extensions to General MIDI, so files that use XG instruments may be rendered more accurately via MIDPlug than by your sound card.

When you access a Web page with embedded MIDI data, MIDPlug comes to life in the form of a simple control panel, with start, pause, and stop buttons. Right-clicking the panel brings up additional options, including tempo changes and transpositions. Unfortunately, there are no forward and backward controls, and unlike some other MIDI plug-in players, MIDPlug doesn't let you create file queues.

Developers who create pages with MIDPlug in mind can use

HTML statements to regulate the size of the control panel—or make it invisible. Other HTML options let you set your music for single play or continuous repeat.

Impressive sound quality aside, MIDPlug's best feature is its price.—CS



MIDI MANAGER: MIDPlug's control panel provides start, stop, and pause controls.

MUSIC

Learn to Play Your PC

PC Music Studio is a full-featured keyboard and music teacher in a box.—By Craig Stinson

Is there a frustrated musician lurking within you? Voyetra Technologies and Yamaha Corp. have teamed up to produce the PC Music Studio. This \$300 duet includes a portable MIDI keyboard and an edutainment CD-ROM filled with

and use it as an input device. With a suitable MIDI sequencing program, you can improvise at the keyboard and record your work at the computer for editing and playback.

Like other members of Yamaha's keyboard line, the PSR-220 displays its current option settings in a 2-inch square LCD panel. The iconography is complex, and the panel is illegible in dim light, but it's otherwise a serviceable road map to the product's myriad features. These include 100 MIDI and 128 General MIDI voices (instrument sounds), a complete drum set, the ability to

split the keyboard between two voices or overlay two voices (to play a harpsichord melody against a string-orchestra background, for example), and more. Voices can be enriched with chorus, echo, and reverb.

enough to enrich a single-note bass line with the appropriate chords. Sixteen demo songs are included, and you can use a Music Minus One mode to shut off the the bass or melody component and play along.

The most useful component of the Voyetra CD-ROM is a set of multimedia piano lessons. The PC's infinitely patient instructor uses video to demonstrate proper hand positioning and fingering. Well-designed screens teach the rudiments of musical notation and take you from simple five-finger exercises through scales and simple songs. As long as you hook up the keyboard to supply MIDI input, you can play the exercises and receive evaluations and suggestions from the computer.

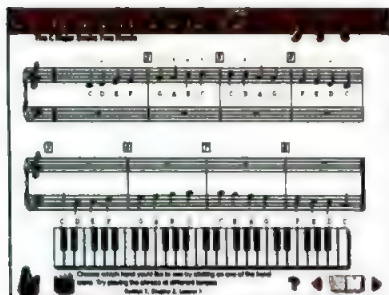
Here, however, the software may sometimes lead you astray, because the system proved unable to distinguish consistently between rhythmic and pitch mistakes. If the student lagged a beat behind the

exercise but played the notes correctly, the software reported missed pitches instead of rhythmic lapses.

Along with the lessons, Discovering Keyboards briefly retells the history of keyboard instruments from the baroque era on through electronic times. And there are some useful drill-and-practice games to reinforce your understanding of musical notation and history.

Within the obvious limitations of this scheme, the CD does an admirable job of conveying the fundamentals of keyboard playing. If you've already progressed that far, however, you might do better to skip the disk and just buy the keyboard—an impressive value for any player.

PC Music Studio. Street price: \$300. Requires: Yamaha Corp. of America, Buena Park, CA; 800-823-6414, 714-522-9011; www.yamaha.com. Circle 403 on reader service card.



MIDI MAESTRO: The CD-ROM component includes computer-based training for beginning keyboard players.

piano lessons, musical games, and historical lore.

The included Yamaha's PSR-220 keyboard is a polyphonic (31 simultaneous notes), velocity-sensitive, 61-key table-top MIDI keyboard that runs on either six D batteries or an AC outlet; an adapter is included. The package includes a MIDI cable with a joystick-port connector, so you can plug it into your sound card



PC GRAND PIANO: The Yamaha PSR-220 is a full-featured piano keyboard with a wide assortment of MIDI sounds, a complete drum set, and automatic accompaniment.

First Looks

SCANNERS

The Scanner with Depth

The MicroScribe-3D opens new vistas for both artists and engineers.—By Daniel Grotta and Sally Wiener Grotta

Scanning photographs or other flat documents is a relatively simple matter of placing the original on a flatbed scanner's glass scanning bed, closing the cover, and starting the device. Scanning in the three dimensions that define our world, however, is far more complex and demanding, and until now was nearly impossible for PC users to accomplish. Immersion Corp.'s \$2,995 MicroScribe-3D scanner is a precision tabletop device that can turn small or medium-size objects into accurate 3-D files.

The eye is naturally drawn to the red and black articulated arm mounted on MicroScribe-3D's asymmetrical base. In general, the device looks like a miniature dentist's drill. The 8-pound graphite and aluminum device has a three-joint arm that moves effortlessly as it encircles the object being scanned. Fully extended, the arm reaches approximately 25 inches. When you add an additional 6 inches for the base, you have a device with a potential 330-degree scanning radius for objects up to 60 inches wide.

POINTING THE WAY

At the end of the arm is a low-friction graphite stylus with a pointed steel tip, which can be replaced with a round ball and an even sharper tip for specialty applications. The tip gently rubs against the article to be copied, producing a replica of the object's surface contours.

The MicroScribe-3D scanner is a serial device that operates at 38 Kbps. The COM port must be selected manually, however, and most users will probably need to tweak the software's default settings.

This is not an automatic device that scans an article while

you watch. The MicroScribe-3D requires a careful eye, a light touch, and a modicum of coordination. Before you get going, you'll need to calibrate the stylus. You do this by using the system's foot pedals, which correspond to left and right mouse buttons. Just click on the front-left, front-right, and rear-right coordinates of the object.

From a practical point of view, object

you select the MicroScribe-3D's polygon tool, place the stylus point where you wish to begin, hold your foot on the pedal, and carefully follow the object's contours. We found that this can place too many nodes into a curve, however, resulting in a jerky image for those objects that have subtle or compound curves. The second method is to use the foot pedal to click on each point where you want a node. Double-clicking the foot pedal ends a scan line.

A 3-D model of the scanned

thing with a little more resistance to movement. In addition, using the foot pedal proved awkward, and we would have rather used buttons, the PC's keyboard, or even a mouse to control the system's scanning arm.

Although the arm is segmented in three places and has a wide maneuvering radius, most of its joints don't rotate through a full 360 degrees. The result is that the arm sometimes stops short when tracing certain paths. There is no way around this shortcoming; you can only start over from another angle.

Once the object is traced, it can be further edited and augmented using MicroScribe-3D's Amapi software, and saved in a number of common 3-D formats for use in other programs. Immersion offers several plug-ins for popular 3-D applications such as AutoCad, Lightwave, Studio Pro, and 3D Studio, as well as a general Microsoft Windows driver.

PRACTICE MAKES PERFECT

Though using the MicroScribe-3D entailed a very steep learning curve, we can see the product's value, because it allows you to produce realistic representations of real-world objects for use with a computer. This unique device will be equally useful to engineers who need to digitize a three-dimensional object and to digital artists who wish to impart a realistic edge to their work.

But don't expect an easy time with the MicroScribe-3D.

MicroScribe-3D. List price: \$2,995. Requires: 4MB RAM, 15MB hard disk space, PC serial port, Microsoft Windows 3.x or later. Immersion Corp., San Jose, CA; 888-467-1900, 408 467-1900; www.immerse.com. Circle 406 on reader service card.



NOW YOU SEE IT: MicroScribe-3D's articulated arm can trace just about any object and create a wireframe representation (top).

placement is critical: Objects must be arranged near the scanner, but not so close that movement of the arm is impeded. And it's crucial that the object being scanned remain completely immobile; we had to either weigh it down or use clamps. Otherwise, the moving stylus may nudge it, trace the wrong path, and produce an inaccurate image.

The device uses two scan modes: With the first method,

object is created in the computer by starting and stopping a number of scan lines around the object. The result is not unlike a topographical contour map, with areas of equal height represented by parallel lines.

It may sound and look easy, but in practice, following complex shapes and contours is difficult, demanding, and time-consuming. Our first attempts were comical. It took hours of practice before we were able to make a recognizable trace. Fortunately, the \$200 Amapi software has a snap-to command and one level of undo, which helped transform our childish-looking images into something more usable.

ARMED AND READY

We were continually frustrated by the fluidity of the arm, which moved too easily, and we would have preferred some-

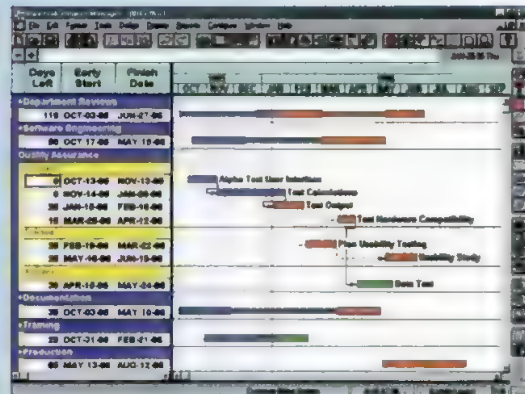
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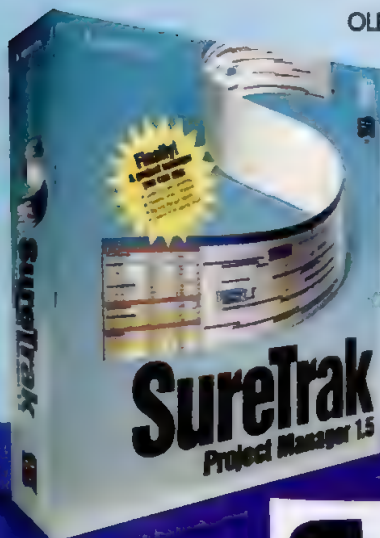
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First Looks

PDA's

Paging Dr. Stylistic

Want to roam around your office but stay connected to your LAN? Try Fujitsu's wireless Stylistic 1000 RF.

—By Robert Norton

Fujitsu and Proxim advance the state of the art for wireless hand-held computers with the \$5,560 Stylistic 1000 RF. Best for applications designed for mobile computing, this 3.7-pound, pen-based tablet PC is compact and portable. It will likely be a boon to nomadic workers who need to stay on the corporate LAN regardless of where they wander.

At 7.3 by 11.0 by 1.6 inches, the Stylistic feels good in the hand, thanks to the sculpted hand grip on the left side. Based on an AMD 486 DX4/100 processor, the Stylistic comes with a meager 8MB of RAM, which is expandable to 40MB. The unit also has either 260MB or 340MB of PC Card hard disk space, a serial port, a parallel port, and an 8-inch passive-matrix color VGA display. For expansion, you're restricted to using the system's pair of Type II PC Card slots. There's also an infrared IrDA port for moving data to a printer or another PC.

HAND POWER

These specifications may sound anemic by current notebook standards, but the optional accessories—including a low-power keyboard, a port replicator, an external floppy disk drive, and connections for an external monitor—can help turn this tablet into an adequate desktop PC. Our biggest disappointments were the limited hard disk capacity and generally sluggish Microsoft Windows 95 performance.

The screen's digitizing element has a resolution of over 1,000 points per inch and samples at more than 100 points

per second. The Stylistic's included software, CIC Handwriting Recognition 4.0, is paired with a metal pen that uses AAAA batteries. But while some of us were able to obtain reliably near-perfect recognition, others' handwriting proved unintelligible.

On the other hand, we expect that most Stylistic applications will rely on check-off boxes and multiple-choice questions. Overall, we felt that the handwriting recognition software was better than in most non-Graffiti-based systems.

Setting up the machine was simple and quick; the wireless networking software came right up without a hitch. The Stylistic uses Proxim's \$1,895 Range-LAN2 Access Points and PC Cards to build a wireless infrastructure. Communications between the Access Points and the Stylistic tablet occur via a 2.4-GHz spread-spectrum system, which is capable of 1.6-Mbps throughput and has a claimed maximum range of 200 feet.

One Access Point—sufficient for a small office without obstructions—automatically configured itself to run on our Ethernet network. But to use more than one Access Point—necessary for a larger office—you must configure and customize them manually. With Proxim's Inband configuration program, we were able to configure the system from the wireless tablets themselves (once a connection was made, of course).

Fujitsu sells the Stylistic

package through a small group of resellers knowledgeable about its targeted markets: the health-care, insurance, law-enforcement, and warehousing industries, among others. Before, a reseller will need to do a site survey of your location to determine how many network Access Points you need and where you should put them for the best results.

Once we set up the Access Points, we were able to wander between them, with the system automatically handing off transmission to the clearest, strongest connection. To make it all work, we had to put some time and ef-



HANDFUL OF DATA: The Stylistic 1000 RF communicates with the network via a spread spectrum system and a series of Access Points.

fort into using a mobile computing protocol, such as Mobile IP or Mobile IPX.

Management and administration were straightforward and fairly intuitive. Each Access Point has a security ID, and each wireless unit appears to the server to be just like any other network client. As we wandered around the office landscape, we found that the Stylistic performed well overall. The unit had a good range even without resorting to an extended-distance antenna, which can get in the way. At about 75 feet from the Access Point, throughput between the tablet and the network became unreliable.

In hands-on use, the Stylistic's standard 8MB of RAM seemed sluggish, particularly when we ran Windows 95. We strongly recommend the \$500 upgrade to 16MB of memory.

While the 8-inch screen can't compete with the 12.1-inch active-matrix displays that now adorn the top-line notebooks, we found it usable, if a bit cramped at times. And the unit's clipboard size and light weight were bonuses.

HALF-DAY BATTERIES

During our evaluation, the Stylistic's lithium ion batteries were able to last for about 3 hours of active use. This result is favorable compared with the performance of other notebook PCs, but it wouldn't enable a full workday of use away from a power outlet. The saving grace is that you can hot-swap the system's battery packs.

In the future, we'd like to see the use of a Pentium CPU, so the unit could deal better with the extra overhead from Windows 95 and wireless networking. In addition, the Stylistic would benefit from a built-in 10Base-T port; it would let you connect

directly to the network at times when wireless communications would slow you down, such as when downloading large files or performing heavy-duty computational tasks.

Despite its spotty handwriting recognition software, lethargic performance, and insufficient hard disk capacity, the Stylistic 1000 RF offers easy setup, flexibility for shifting between desktop use and roaming around, and excellent management features. These qualities make it a good choice for those who need to work on the go.

Fujitsu Stylistic 1000 RF. List price: With AMD Am486 DX4/100 CPU, 8MB RAM, 340MB hard disk space, 8-inch DSTN color display, \$5,560. Fujitsu Personal Systems Inc., Santa Clara, CA; 800-831-3183; fax, 408-496-0609; www.fpsi.fujitsu.com. Circle 401 on reader service card.

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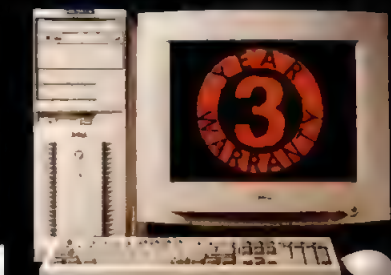
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First Looks

SCANNING SOFTWARE

The PC Scanning Center

NewSoft pulls a rabbit out of your PC with its all-in-one scanning software.—By Melissa J. Perenson

NewSoft's \$169 Presto! PageManager Suite combines eight integrated applications for managing and manipulating scanned files. Though it is rough around the edges and lacks a unified interface, PageManager Suite is an economical, all-in-one scanning center.

While Visioneer's popular PaperPort software (First Looks, January 9, 1996) supports only gray-scale images, PageManager Suite supports full color. As a bonus, the suite comes with MetaTools' Kai's Power GOOSE, an image-manipulation program for stretching images to their limits (First Looks, October 8, 1996). Installation of this Twain-compatible package was easy, but it doesn't have an uninstall option.

PageManager is used for organizing and filing your scanned images. Like PaperPort, PageManager displays thumbnails of scanned images on-screen.

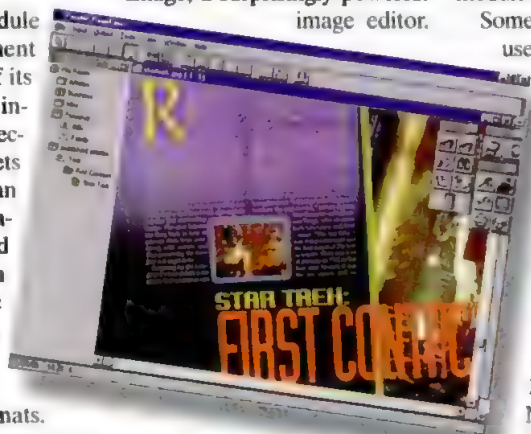
The package includes a strong set of annotation tools: You can drag and drop text, highlight words and phrases, and add free-form text annotations. Cropping and rotating images is easy. Another nice feature is the inclusion of a text-view button, which provides an instant optical character recognition (OCR) scan of the image and displays the results on-screen.

To do more with a image, you can launch a companion program by dragging and dropping the image onto any of the application link icons on the bottom of the screen. You can add any application that supports ASCII, BMP, PCX, or TIFF formats.

The PageFiler module is a capable document organizer, in spite of its confusingly layered interface. PageFiler's electronic filing cabinet lets you copy, fax, or scan directly into applications, and capture and edit images. You can perform fuzzy-logic searches to retrieve archived documents and import a variety of document formats.

One of PageManager Suite's strongest components is Presto! Forms, which makes it easy to scan in forms and then fill in the

blanks on-screen. To get the same functionality from PaperPort, you'd have to purchase Visioneer's \$20 FormTyper add-in (Second Looks, July 1996). Also notable is Presto! PageImage, a surprisingly powerful image editor.



SCAN CENTRAL: Presto! PageManager Suite merges all scanning functionality into a single program.

Presto! Wordlinx uses Recore's OCR engine to perform quick and accurate character recognition that is displayed in the Windows' Notepad. The suite's weak link is the BizCard business-card module's confusing interface.

Some of its components could use a little polishing, but

Presto! PageManager Suite has a lot of tricks up its sleeve to help you get the most out of your scanner.

Presto! PageManager Suite. List price: \$169. Requires: 8MB RAM, 30MB hard disk space, Twain-compliant scanner, Microsoft Windows 3.1 or Windows 95. NewSoft Inc., Fremont, CA; 800-214-7059, 510-252-0267; www.tophat.com. Circle 404 on reader service card.

UTILITIES

News Without the Wires

Global Village's NewsCatcher provides all the news that's fit to broadcast.—By Jon Kaufthal

With its blinking light and jet-black pyramid-shaped case, Global Village Communication's \$150 NewsCatcher allows you to receive up-to-the-minute news broadcasts wirelessly on your PC. Think of it as PointCast Network without wires. Making use of a wireless news service used by pagers, NewsCatcher gets news head-

lines, sports scores, and stock quotes without having to connect to the Internet.

One year of basic service comes with NewsCatcher, but we think most will choose the premium service, which provides more news more frequently and costs \$4 per month. You get this level of service free for 90 days.

NewsCatcher is a simple alternative to PointCast Network or Freeloader. Just plug the receiver into your computer's serial port and you're ready to receive news. NewsCatcher's simple graphical format provides one-click access to stories and notices when you have e-mail waiting.

NewsCatcher's software was written by AirMedia Live, the company that provides the

broadcast service; at present, the service reaches about 90 percent of the U.S. population. When it gets a news item, NewsCatcher displays a small icon (an animated puck for hockey news, a dollar sign for business items) flying across your computer's screen, complete with sound effects, which you can disable.

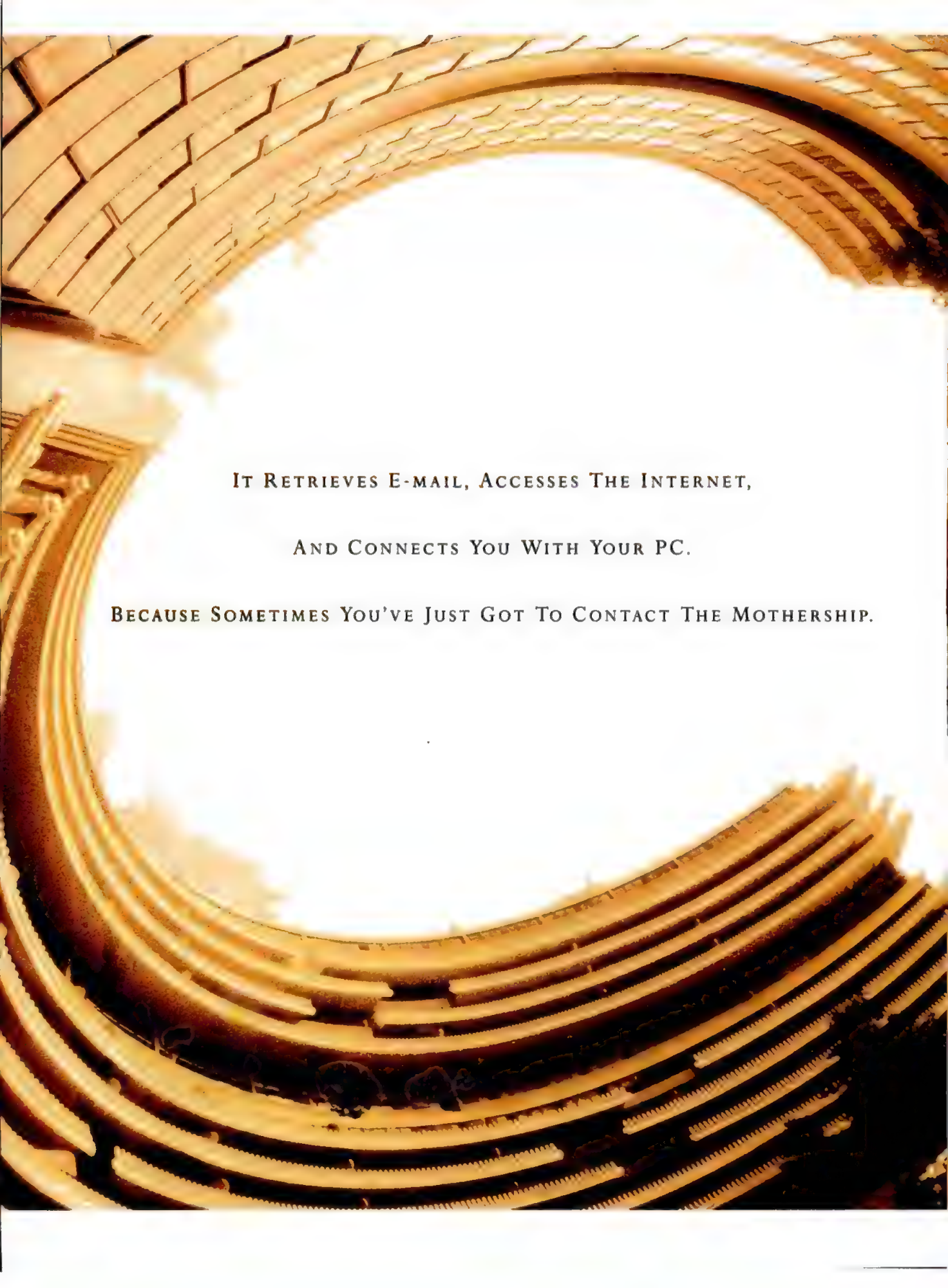
To read an item, you can use NewsCatcher's toolbar, when clicked, its icons launch separate windows. We prefer the control given by the software's remote window, which has configuration options and access to older stories.

For those who can't or don't want to access the Internet for news, NewsCatcher keeps you up-to-date on all of the latest events—without wires.

NewsCatcher. Street price: \$150. Requires: 16MB RAM, 30MB hard disk space, Microsoft Windows 95. Global Village Communication Inc., Sunnyvale, CA; 800-227-0697, 408-523-1000; www.globalvillage.com. Circle 409 on reader service card.



PYRAMID POWER: NewsCatcher's receiver brings stock quotes to your PC (inset) without wires.



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First Looks

BOOKS

The Lawful Frontier

Five books that help you find your legal way in cyberspace.—By Robert Daly

Law and the Internet are two terms that just don't sound as if they go together. Since its inception, the Internet has been viewed by users as a place of anarchy where all that was needed was some basic etiquette, not laws. It's

a romantic notion; but all communities have to have laws.

The major problem with enforcing law on the Net is that few users truly understand the applicable laws. That is changing though as the Net becomes

more mainstream and instances of abuse more commonplace.

Recently, much attention has been focused on the role of law in the online community, in part because of legal challenges to the Communications Decency Act, part of the telecommunications bill. But First Amendment issues aren't the only concern of the Web. With billions of dollars in

transactions taking place on the Net, the application of commercial law to the online world is becoming increasingly important. The five books reviewed here run the gamut from *Sex, Laws, and Cyberspace*, a small book designed for a wide audience, to *Law and the Information Superhighway*, a dense but comprehensive and authoritative legal text.

Visit www.pcmag.com/discuss.htm December 30 to January 3 to discuss law and the Internet.

WWW.PCMAG.COM

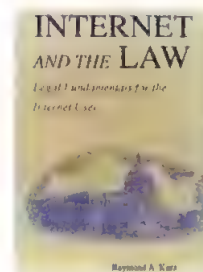
From Copyright to Cybersex



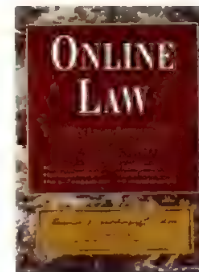
■ Ever wonder what happened to the California couple who ran an adult BBS and wound up on trial in Tennessee for distributing pornography? Or the man who was arrested for posting portions of the Church of Scientology's sacred text on the Internet? *Sex, Laws, and Cyberspace* (\$24.95), by Jonathan Wallace and Mark Mangan, follows up on these and other well-known free speech and privacy cases related to the Internet. Each chapter gives brief but detailed coverage of a specific case, including events leading up to and following the trial. The common theme running throughout this work is not that government intervention is bad, but that the legal system is having trouble applying existing laws to the rapidly evolving Internet. www.spectacle.org/freespch; ISBN: 0805047670.



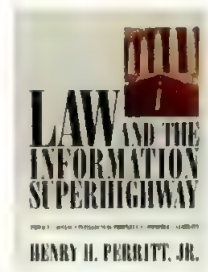
■ If you have no legal background, but you have questions about your rights to privacy when using the Internet, *Cyberspace and the Law* (\$19.95), by Edward A. Cavazos and Gavino Morin, can be extremely useful. Aimed at the average citizen, the book goes beyond intellectual property law—which is of concern mostly to businesses—and covers important civil and criminal law topics: the Electronic Communications Privacy Act, censorship, defamation, privacy, and the downloading of sexually explicit materials. The authors also try to get their readers involved in the debate over such issues as cryptography. You won't become an instant legal expert after reading this book, but you'll be aware of the basic legal landscape. www.mitpress.mit.edu; ISBN: 0262531232.



■ *Internet and the Law* (\$74.50), by Raymond Kurz, et al., is a good handbook to intellectual property rights written in layman's terms. The book explains and helps steer the reader through the complex field of copyright, patents, trademarks, and trade secrets. All the examples are drawn from common scenarios or potential problems on the Net. The book's appendix includes several useful forms for requesting a copyright, registering a trademark, and securing licensing agreements, as well as a sample confidentiality agreement. If you're looking for a guide to intellectual property law written in straightforward language, *Internet and the Law* belongs on your bookshelf. www.myrna.com/gllindex.htm; ISBN: 0865876065.



■ A good primer on the current laws that govern the Internet, *Online Law* (\$34.95), edited by Thomas J. Smedinghoff, is designed to be a legal handbook. Sponsored by the Software Publishing Association, it covers information security, online transactions, rights and ownership of electronic information, regulation of information content, regulation of online behavior, and other topics. Laymen should not be put off by the book's title—it's written in a very informal manner. But it is also annotated, so even experienced lawyers will find it a valuable resource. One of the more interesting portions of this work is a discussion of domain names: how to register a name and protect against its being hijacked or reverse-hijacked. www.aw.com; ISBN: 02014-89805.



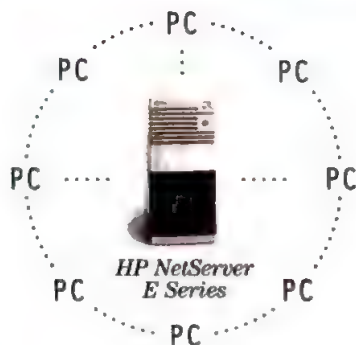
■ For the serious reader with an interest in Internet case law, *Law and the Information Superhighway* (\$135), by Henry H. Perritt, Jr., is a great resource. But be warned: This book is not for the faint-of-heart. It is a bona fide legal text, and it reads like one. After presenting a primer on computer networks and telecommunications, the book devotes itself to case law. Perritt also explores the implications of converging cable TV and phone technologies. The back of the book is devoted to First Amendment and intellectual property rights. But *Law and the Information Superhighway* also covers civil, criminal, and international law, including the effects of such international agreements as GATT and NAFTA on the Internet. www.wiley.com; ISBN: 0471126241.

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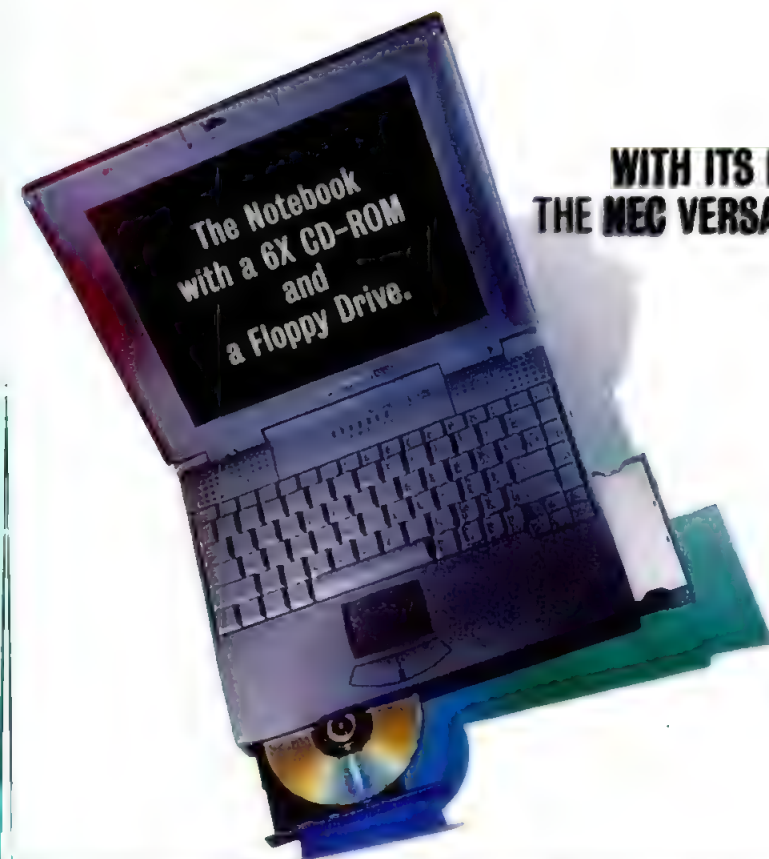
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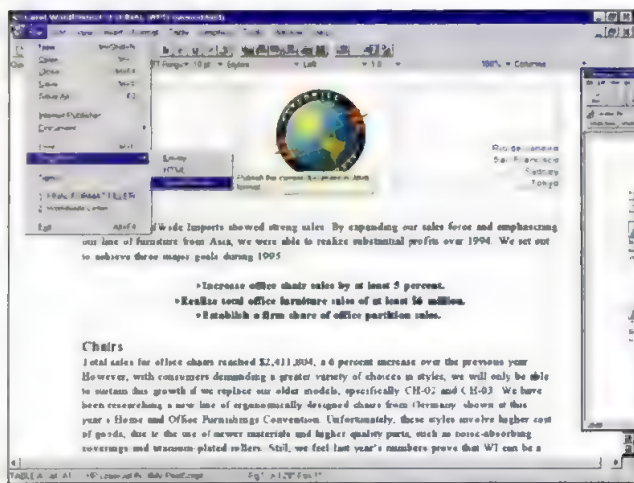
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Second Looks

PDA's

Newton's Flip-Flop

For those of us who never learned to color inside the lines, the Newton MessagePad 120 (First Looks, March 28, 1995), with its vertical stenographer's pad orientation, seems too confining. In this regard, Newton is by no means alone; many PDAs including the HP

OmniGo 100 (First Looks, February 6, 1996) suffer from the same design limitation.

The obvious solution: Turn the unit on its side to produce a wider, shorter screen with more breadth for entering data, writing notes, or just doodling during a boring meeting.



landscape mode; when you click on an icon, the MessagePad changes the arrangement of the screen. The landscape orientation can feel quite liberating: You get about three times the width to work with, making it easier to write. The price you pay, of course, is a shorter page.

Upgrade information is available on Apple's Web site (www.apple.com) or from Apple at 800-767-2775. Newton 2.0 will be incorporated into the upcoming MessagePad 2000, which features a larger screen and a more powerful processor; expect to see it early this year.

Apple has done just that with Newton 2.0, its operating system upgrade. Unfortunately, the upgrade is too complicated to be done by the end user via download. Instead, you have to send your MessagePad to Apple to do the work. The upgrade costs \$109 (including shipping and handling) and is well worth the investment.

Among other improvements, Newton 2.0 lets you switch between portrait mode and land-

INK JET PRINTERS

Instant Desktop Studio

The last time Second Looks turned its gaze to digital photography ("Camera Ins and Outs," December 17, 1996), we lamented the lack of affordable color printers capable of producing high-quality photographic images. Well, a lot has changed in those three weeks.

For those who were hoping that Santa would leave an ink jet printer under the tree and those who have already invested in a recent Canon Bubble Jet printer, the news is good and really good. For starters, in addition to standard and neon inks, Canon has come out with a spectacular new generation of inks for models BJC-240, BJC-

4200, and BJC-4550 ("Personal Printers Showdown," November 5, 1996) that improve the quality of photographic prints markedly. Not only are Photo Inks better inks, but the precision with which the cartridges place ink on the page has been improved dramatically.

While standard inks can look washed out and dull, the photo-quality inks are bright, vibrant, and well saturated, without looking artificial. You can really see the difference

when you look at how the inks handle skin tones (which look lifelike), shaded regions (which retain their sharpness and color), and the subtle shadings of grass and trees (which appear natural).

Now for the really good news: If you bought a BJC-4200 or BJC-4550 printer between October 1996 and the end of the year, you can get a free Photo Inks cartridge—a \$50 value—along with 60 sheets of Canon's HR-101 letter-size, high-resolution paper, which helps get the most out of these inks. Call Canon at 800-526-4345 or visit the company's Web site (www.ccsi.canon.com) for more details.

The downsides to Photo Inks are time and money: It takes about 10 minutes to create a letter-size print, and output costs about 50 cents per page. But Photo Inks go a long way toward turning your PC and printer into a digital photograph enlarger.

ISDN

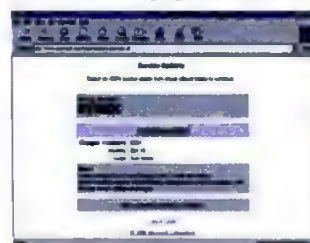
The ISDN Answer Page

When we last checked in on the world of digital communications, ISDN lines were becoming easier to get and use, but they were still far from universal communications portals (First Looks, October 8, 1996). In the intervening months, Microsoft's Web site has added a special ISDN page.

If you're tired of twiddling your thumbs while waiting for a long download to finish, go to www.microsoft.com/windows/

[getisdn.com](http://www.getisdn.com). You'll find the expected FAQs and specs that describe what these digital devices are capable of. Next, jump to the order page, click on your location, enter your phone number and the server will send back a page with your local service providers, installation costs, monthly fees, and service options.

So if you're hankering to have the fastest connection on the block, get the straight dope from the Get ISDN page first.



SECOND LOOKS MAILBOX: Tell Second Looks about your experiences with computer products. Contact Brian Nadel via MCI Mail (556-1500), CompuServe (72241.1616), or the Internet (bnadel@zd.com).



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CIRCLE 266 ON READER SERVICE CARD

Web Browsing Without a Computer

I've just spent most of the day browsing the Web. In my family room. Where there's no computer. On television. With a video game machine. I've been test-driving the Sega Saturn Net Link, a plug-in for the popular Saturn game machine, and comparing

it with computer-based surfing. As a card-carrying computer junkie, I was heavily prejudiced against the idea of using a video game and TV set as a window onto the Web, but I agreed to give it a try. After all, major consumer electronics companies are still investing millions of dollars in the basic idea of convergence. Although most of the convergence schemes have been about as substantial as one of those gaudily frosted cardboard cakes in the baker's window, it's still important to look at new ones as they emerge. One of them might make a nourishing meal.

The Sega Net Link is a simple black module that you slip into the expansion port on a Saturn. It has two RJ-11 jacks in the side: one for the line, one for the phone. You boot with a CD-ROM, and the next thing you know, there's a Web browser up there on your TV screen. Of course, it looks utterly unlike any Web browser you've seen from the likes of Microsoft and Netscape, but that's probably appropriate for this market.

For starters, the menu bar at the top of the screen is transparent. It lets you see images underlying the bar, which is a clever way to make the most of the TV screen's limited real estate. Remember, no matter how big a TV is, it still displays a bit less information than a 640- by 480-pixel VGA screen. If you make the screen bigger, the pixels just get bigger—and more ragged-looking. I'm using the Saturn on a 55-inch rear-projection screen, which is dynamite for games but actually harder for reading text, unless you get back far enough from the screen to let the anti-aliased characters do their magic.

Anyone who has ever played a video game is well schooled in the accompanying sound effects—boinks and doinks and swooshes and whooshes. They're all here, even as you go through mundane tasks like setting up your service provider. My subwoofers and surround sound made the effects a bit much, though. Sega, by the way, has teamed up with Concentric.net, so if you don't have an ISP, you can sign up right from your easy chair by accepting a bunch of defaults. If you already have a service provider, no problem. You enter your user name, your

password, a couple of IP addresses, and a phone number, and you're up and running. It's so simple, it took me only an hour. My 11-year-old son probably could have done it in 5 minutes, but kids today are born knowing how to use direction pads and buttons to interface with everything from kickboxers to intergalactic cruisers.

For me, working through the on-screen QWERTY keyboard was agonizingly slow. No cut. No paste. No cursor keys. Just that blasted little rocker pad and a bunch of buttons.

Once you get everything running, however, you can sit back and point and click to your heart's content. The PlanetWeb browser is now in its own element, dishing up subtly reformatted screens and enlarged, anti-aliased text to compensate for the TV's lower resolution. The first place it takes you, however, is Planet Oasis, another one of those dreadful 3-D virtual cities that looks as if it were constructed in SimCity 2000. The failure of the concept is evident in the fact that every city block and building is labeled, since shape alone can't tell you what something is. Okay, the Gatorade bottle and the big Warner Brothers logo are notable exceptions. But couldn't the site just give us a nice, neat list instead of icing over cardboard? Perhaps I shouldn't complain too much, since our own ZD Net is one of the links. (Planet Oasis actually looks better when you view it from a regular browser on your computer screen.)

That said, surfing in front of the TV set is a vastly different experience from surfing on the PC. I'm leaning back, not forward. I'm avoiding sites that require typing, drilling down through Yahoo! instead of searching from Alta Vista. I'm going to sites that the whole family can enjoy, without everyone crowding around the screen. For sheer information density, the TV is no match for a 17-inch monitor and a 1,024-by-768 display, but the computer is no match for the convivial atmosphere created by the TV, either.

My eyes are tired. My thumbs are sore. But I've experienced the Web a new way. □



ARMCHAIR SURFING

I was prejudiced against using a TV as a window onto the Web, but I thought I'd give it a try.

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What's New for '97

I haven't done a predictions column for a decade. As I've said in the past, most predictions are actually inside information under the guise of prognostication. But this year so many revolutionary changes are in the works that I thought it would be useful to outline

certain trends that I see taking shape. Here are ten predictions for 1997.

1. Digital photography takes off. Every camera maker is going gangbusters to develop digital systems. Prices for a usable camera should be under \$500. Also expect to see a slew of compact, all-purpose cameras that record sound and video as well as still photographs.

2. Photo-realistic color printing becomes a huge success. The HP 693 and the ALPs solid ink printer, along with a pile of other inexpensive color printers capable of dye sublimation-quality printing, will be the rage. Kodak told me nearly a year ago that it won't promote dye sublimation for the home market because new, cheaper technologies promise to deliver incredible pictures with an ink jet. People will want to print digital pictures taken with their own cameras and from the Web.

3. Web TVs pick up speed. The major TV makers will introduce so-called "Web TVs": high-resolution, broadcast TV sets capable of surfing the Web at 640-by-480 resolution. Some systems may actually be 320-by-240 resolution and require special content for viewing. These units should meet with moderate success. Serious Web users, though, will surf at 1,024-by-768 or higher at a workstation, not a TV set.

4. Network computers remain up for grabs. 1997 will not be the year of the network computer. But it will also not see its demise. By this time next year, we'll still be debating its viability. Every major manufacturer will indicate interest in the concept, and the basic design will become more practical as components get cheaper.

5. No Web collapse. 1997 will not be the year when a so-called collapse of the Web and of the Internet in general occurs. Slow sites will continue to be slow, and everyone will continue to upgrade their servers. Instead, 1997 will be the year of the server; any company making them will do well, with Sun leading the pack. Pentium Pro servers, though, will show the fastest growth as people begin to switch to the Pentium Pro as a mainstream platform.

6. AMD makes a comeback. Advanced Micro Devices will have a huge year as it jumps back into the "Let's clone

Intel" business with the K6 processor, which should give the company new life. A series of expensive TV ads will help. There is no reason why these guys can't once again be Intel's number-one nemesis.

7. Bandwidth gets bigger, slowly. It's still a 28.8-Kbps world struggling to go faster. 1997 will not be the year when the world switches to cable modems, ATM, or ADSL to access the Internet. Smart users will still find ISDN their best bet for fast access, although the 56-Kbps modems should be shipping in quantity and should serve the function of showing us how ratty much of the wiring in this country has become. The most popular Web accessories and utilities will center around ways to compress and speed up the site for the mid-speed (28.8/33.6) user. As an interim fix for power users, the satellite download systems will achieve moderate success.

8. Apple makes a comeback, too. Apple's dedicated users will allow the company to experiment with products long enough to find new success with some forward-thinking machines that promote interactive videophone-like capabilities. This technology has been sitting around at Apple for years; they have made prototypes of monitors with both a built-in camera and a built-in microphone. This is the one invention they need to pull out of the labs and put on the desktop.

9. Java buzz gets louder. The buzz surrounding Java will continue throughout the year, much to the chagrin of Microsoft. Much of

the stir will be caused by IBM and its total commitment to Java. OS/2 and other IBM projects will be put on the back burner, although there is no reason to suspect that OS/2 will be discontinued since it provides an excellent proprietary system for mission-critical environments. But as a desktop OS competing with future versions of Windows, it is now moot.

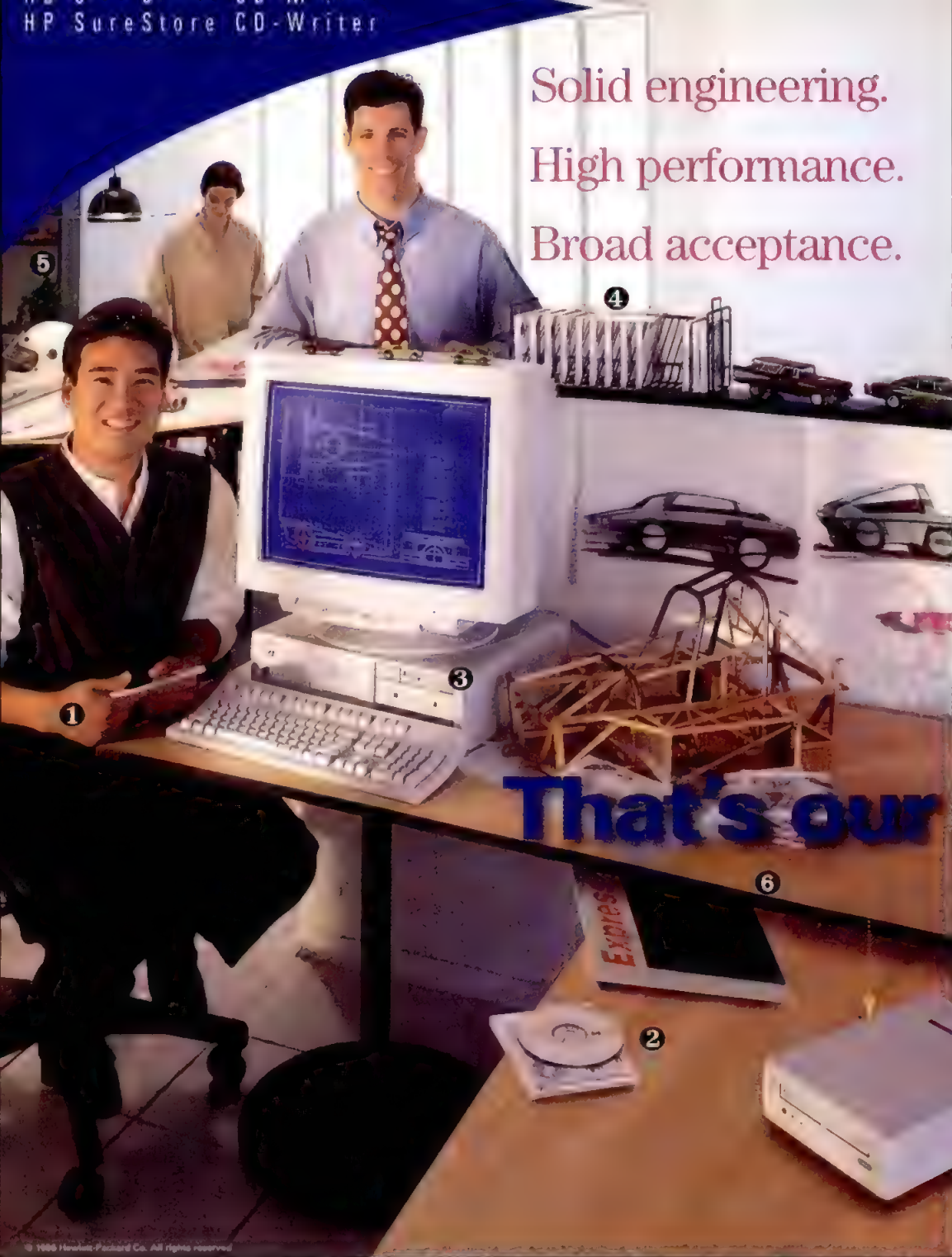
10. Office 97 is a huge success. Office 97 should be the hot seller among software in 1997. The product has megawinner written all over it. The fly in the ointment will remain the potential for Word to carry macro viruses and time bombs within the document itself. This Word macro virus issue will probably be picked up by the major media in 1997.



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1997 will not be the year of the network computer. But neither will 1997 see its demise.

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Inside Track

The chip market is **heating up**, with new companies showing up out of the blue with important microprocessor announcements. Leading the pack is a newbie named

Exponential Technology, with a **souped-up** PowerPC-compatible chip that runs at a **blazing 533 MHz**. While it's faster than the dickens, the price is paid in increased power consumption. If you thought the early Pentiums were hot, this baby chews up 85 watts. **A laptop melter**. I expect to see more and more oddball companies introducing new chips over the next 24 months. Intel has shown people the way to make a fortune, and now everyone wants a piece of the action. Anyway, this chip gives hope to the PowerPC line of processors. An added boost to that market comes from the new 240-MHz version of the PowerPC 603. If MMX doesn't live up to expectations, these chips might **still be a threat** to Intel.

While on the Subject of MMX Dept.: At a recent conference, I learned that AMD, which is incorporating MMX into its upcoming K6 chip, has a **potential advantage** over Intel. While Intel's MMX design typically has a 32K cache for data and instructions (as opposed to the typical Pentium's 16K), the AMD chips will boost the cache to 64K. According to PC Magazine Labs, **most of the performance boost** from MMX when running standard programs probably comes from the added cache alone. If that's the case, the AMD chip could be a formidable competitor. We'll see.

Intel Has Lost an Important VP Dept.: I was stunned when an Intel fixture, David House, quit to join Bay Networks. House was an Andy Grove protégé who even more than his mentor **typified** Intel's aggressive and arrogant style. He was always fun to talk to. It was also a kick to watch him annoy the competition. Exactly how he'll fare outside of the Intel corporate culture will make for an interesting study. It should also be interesting to see how his departure affects Intel.

Gee, These Guys Are Serious Dept.: Sun Microsystems actually rolled out a prototype of its new network computer (NC), hoping to get it to **market by Christmas**. The bad news is this \$500 computer will cost between \$700 and \$1,000, about the same price as a low-end PC clone. At these prices, I think they're missing their own point.

Hottest Rumor in the Valley Dept.: As Microsoft readies Windows 97, Apple's horrendous problems getting Copland (System 8) out the door could result in a new direction for that company. At least that's the rumor. If nothing else, it looks as if Gil Amelio is talking about **releasing a new line of computers** that do not use the Mac OS. The ninny in the Apple community are **abuzz** over this, sug-

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formidable competitor.

gesting that a port of the oddball Be operating system, from Be Inc.'s BeBox, or any number of alternatives are in the works. One long-term Apple maven suggests that Apple is working on some sort of Java-based OS—whatever that might be. More likely is the obvious scenario: Apple intends to roll out a line of **PC-compatible machines**. The company has lots of manufacturing prowess and could make a great PC clone.

The model for this is Apple's longtime partner, Sony. Look at what that company did. It dumped its Beta video format to make high-end, high-quality VHS decks, while making Hi-8 camcorders, Betacam professional equipment, and DAT professional gear. Sony **swallowed** its pride, and the company is now sitting pretty. Apple

could easily bite a similar bullet and compete with Compaq for leadership in the PC market. It could still make **graphics workstations** using the Mac OS, too. It's the logical step. Look for it to be announced by midyear.

Genuinely Interesting Software Dept.: It doesn't happen often, but it's still a costly mistake. I log onto one of the computers to which I'm sending a column. It might be in Canada, for example. I go get a cup of coffee during the upload and flick on the TV. Something interesting is on. Hmmm. I watch for an hour and come back to my desk to discover I'm still online to Manitoba! And then I get a bill for \$20 for the call. Finally, someone has come up with a utility to **stop this** from happening. The product is from Dagar Software, it's called Di\$connect, and it sells for \$29.95. The way it works is simple: The program dumps the connection after a user fails to acknowledge **two video and audio warnings**. It works with Netscape Navigator, Dow Jones, and a host of other programs and online services. Call the company at 203-393-2000 or visit www.dagar.com for more information.

Coming to a Screen Near You Dept.: As I've reported in a number of columns, the **large plasma displays** (42 inches and larger) that are being shown are fantastic. The best are from Fujitsu, and it appears that large plasma monitors will soon hit the streets. At \$5,000, they won't be cheap, but the company thinks it can eventually get the price down to the level of projection TVs. The quality of the plasma display is far superior. I expect to see a **home TV system announced within six months**. The company expects to pump out 10,000 units a month, ramping to 100,000 a month in three years. It looks as if this technology will become the flat-screen, hang-on-the-wall TV we've been waiting for. If the technology ramps fast enough, the stalled digital micromirror technology (from Texas Instruments), which showed so much promise but ran into yield problems, will be **bulldozed into oblivion**. □



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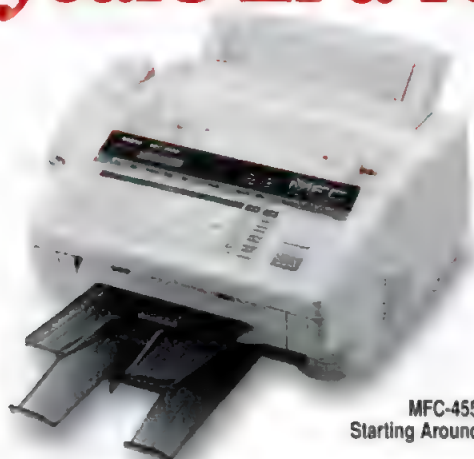
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HP's and Canon's Overlooked Gems

Too often, great new PC products are released to an enormous . . . silence. When the PC Hype Machine is well tuned, the publicity can be huge—for example, in the Windows 95 rollout. But when there's a misfire, or when a product is announced

at the same time one of these promotional blizzards is under way for another product—or, more likely, when there's simply not enough money in the budget to stage one of these extravaganzas—great products arrive in a cloud of mystery and too often disappear a few months later, with few sales and zip impact.

Our job at *PC Magazine* is to spot the great products and tell you about them, whether they're accompanied by a PR blitz or not. In that vein, I want to tell you about two really exceptional products—benchmark, maybe best-of-breed products—that slipped into the market in the last few months but have gotten almost no publicity beyond quick-look early reviews. Both have made a big difference in how I work. Both dazzle friends and colleagues, who upon seeing one invariably *want* one. And both represent new high-water marks in usefulness and value.

The first, and my suggestion for product of the year, is the new Hewlett-Packard OmniBook 800CT. It's the lightest, smallest, fastest, most convenient portable PC you can buy. And it achieves that goal with the fewest and least important compromises I can imagine.

There are still, as I began writing here more than two years ago, just three viable positions in the PC notebook market: small and light, big and powerful, and low-cost but still usable. Over time, I've predicted, much of the power and functionality of the second category will migrate to the first and third, and the price of machines in the first category will drop, approaching those in the third group.

The HP OmniBook 800CT illustrates those trends. It has a big, bright, 10.4-inch active-matrix display, a 1.35GB hard disk, 16MB to 48MB of memory, a superb keyboard, a 133-MHz Pentium CPU, and an excellent instant-on/instant-off routine (call it the airport departure-gate feature).

Excuse me, but does that sound like a compromised machine, a less-powerful-and-less-functional-but-that's-the-price-you've-gotta-pay-for-a-small-light-machine box? Uh-uh, I didn't think so.

HP packs all of that into a 3.8-pound, 1.5- by 11- by 7.3-

inch case that's easy to grab and carry. With advanced power management and intelligent use of the screen-brightness control, you'll get about 3 hours from the unit's lithium ion battery. Need more time? The battery is small and light enough that carrying an extra is not a problem.

The 800CT doesn't have an internal floppy disk drive, nor does it have an internal CD-ROM drive. The price includes the usual tiny external 3.5-inch floppy disk drive, and you can buy an HP-brand external 4X CD-ROM for about \$400. The CD-ROM drive isn't tiny—it's about the size of a Sony Discman—but it's not a problem to carry. Carry the PC, battery charger, and floppy disk and CD-ROM drives on a trip and you face a tangle of cords. But the size and convenience of the base unit make it worthwhile.

With prices starting at \$4,200, the 800CT is not cheap, but it is a bargain. I've been using OmniBooks for about three years now, from the early, dim-screen 300 through the 800CT. Some question the OmniBook's built-in mouse—an odd device, attached to the computer by a flat rigid plastic strip, that pops out of the machine's right side. You can use the mouse “flat” (recommended), or it will pop open to a 45-degree angle. Whatever your first impressions, I suggest you give it an hour's try before deciding you don't like it. Nearly everyone I've asked to do that over these three years has wound up liking it, though nearly everyone disliked it at first.

The IBM 560, a great machine, got the publicity this year in the light-and-small notebook category. But while it's one-third of an inch thinner and has a noticeably larger 12.1-inch display, it's also noticeably bigger—11.8 by 8.8 inches—and half a pound heavier. For the truly size- and weight-conscious, the HP OmniBook 800CT is the grab-it-and-go notebook of choice.

My second recommendation among this year's nearly overlooked great products is Canon's PowerShot 600. I've worked, I think, with every sub-\$20,000 digital camera on the market. Most are severely compromised, fancied-up versions of \$10 point-and-shoot disposables. A very few, including entries from Chinon, Kodak, Polaroid, and now Canon,



BEFORE THEIR TIME

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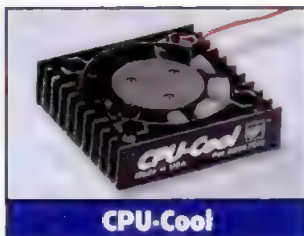
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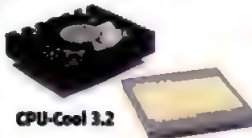


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JIM SEYMOUR

transcend those compromises in ways that deliver genuinely useful results. Of all the sub-\$3,500 digital cameras worth having, the PowerShot 600 is overwhelmingly the best choice.

Yet I'll bet you haven't heard about it, nor seen one in a computer or camera store. Distribution is thin, and Canon is obviously worried about spending big bucks promoting a product for which the market still seems small.

I like the \$950 PowerShot 600 so much that it was going to be the centerpiece of a column I'm working on about the digital-photography revolution. But I felt almost as if it would be cheating to save word about this remarkable camera till I could get that column into print.

I have probably 15,000 miles and several thousand pictures on my PowerShot. It has literally never failed to deliver a usable picture, and it surprises me still with the quality of its images. They are much sharper, with longer tonal scales and color palette, than those I've gotten from anything short of the Kodak/Canon and Kodak/Nikon \$20,000-plus cameras.

Though it's not (unfortunately) a through-the-lens viewing camera, it has a workable system for making very close close-ups. This macro mode produces exceptionally sharp, well-focused pictures down to just 4 inches.

I can store 18 high-resolution (832- by 608-pixel), 24-bit color images in the PowerShot's 1MB of internal flash memory, but I can get 72 on a \$200 4MB PC Card (formerly PCMCIA) memory module, or 900 on a \$350 170MB PC Card hard disk, plugged into the camera's internal (and well-protected) PC Card slot. (Want more? Just carry an extra PC Card device or two.) You have all the usual transfer options through cables and a clever battery-charging/image-transfer base. But the best trick is that if you use either the memory module or hard disk PC Cards, you can just pop those out of the PowerShot and into the PC Card slot in your notebook or desktop PC, from which you can then transfer the JPEG images into Adobe Photoshop for editing or drop them directly into your application.

If you want digital photos for a Web site, for dropping into reports and correspondence, for adding to forms, or for nearly any other use, take a close look at the PowerShot 600. A brilliantly designed and executed product, it's the most interesting and important end-user digital imaging product of 1996.

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Year of the Acronym

What does 1997 hold in store? I believe it will be a good year for the PC industry and the PC user. It will be the year when many, many technologies come together, including all the TLA (three-letter-acronym) technologies of 1996 that didn't quite

arrive on schedule, such as MMX, DVD, and USB. Here are ten predictions for 1997.

1. Big advances in PCs. What you'll be able to buy at the end of 1997, thanks to all those TLAs, represents a big leap in capability over what you can buy now. You'll have an MMX-enabled Pentium CPU (or Pentium Pro) instead of the Pentium Classic, DVD instead of CD-ROM, USB (Universal Serial Bus) in addition to parallel and serial ports, and MPEG-2 decompression instead of MPEG-1, for better-than-cable-quality video. And by year's end, a 10GB hard disk will be standard in some PCs.

2. USB arrives (finally) and flourishes. Or dies. Universal Serial Bus was supposed to have been here by mid-1996. But only now do Microsoft (with drivers) and Intel (with hardware specifications and motherboards) have their acts together. USB will be great for people who want to hang a lot of accessories—scanners, cameras, and printers—off their PCs without opening the cases. But this 12-Mbps bus has taken so long to get going, it could be bumped off when...

3. FireWire arrives (finally). This high-speed bus (up to 400 Mbps) was supposed to complement USB, because FireWire—or IEEE 1394, as it's more properly called—was expected to cost too much to be included in every system. But FireWire may be only marginally more expensive than USB, if the core logic is rolled into the chip set. IEEE 1394 is fast enough to replace the Enhanced IDE or even SCSI standards. In the home, it would link your PC with your audio and video equipment.

4. The Japanese PC makers arrive for good. Sure, except for NEC, they've loused up almost every desktop marketing opportunity of the past decade. But they do understand consumer electronics and CE marketing. Put your money on Toshiba for the short term and Sony for the longer term. (And somebody send Panasonic a wake-up call.)

5. Convergence gets real. You'll see PCs with TV tuners and PCs that are TVs, PCs that control your stereo system and PCs that sound almost as good as your stereo. The breakthrough we're waiting for: enough PC-to-videocamera bandwidth (probably via FireWire) to capture and edit

digital video without any loss of image quality.

6. Network computing shows its bias and goes nowhere fast. It's old "whine" in new bottles: Oracle and Sun and friends don't want Wintel to rule, so they've dusted off the diskless workstation concept and given it a new name. But no matter how good or reliable the connection, do you really want to keep all your data at the other end of a network when a big hard disk costs only \$199? And if his NC vision were to win somehow, does anyone believe Oracle's Larry Ellison would rule the computer world with a kinder, gentler hand than that of Bill Gates?

7. TCO computing takes off. The part about network computing that resonates with IS managers is Total Cost of Ownership (TCO). A sealed box would be more consistent to administer and easier to support: If it fails, you swap out the whole unit. There's no reason a stripped-down, sealed PC can't fit this bill and be cost-competitive with NCs. Note: Any NC or Internet terminal that sells for \$499 is more a set-top box than a complete computer.

8. Intel kills the Pentium Classic. Through pricing and technology, Intel will try to move users this year to the Pentium Pro. Reason: AMD and Cyrix are getting competitive Pentium-class chips out of their fabs. For instance, you'll see AGP (accelerated graphics port, yet another TLA), which speeds up 3-D graphics by bypassing the PCI bus, in support chips for the Pentium Pro only. The Pentium Classic

will get MMX first, but Intel wants vendors to load up those PCs with MMX games so that business users will shy away.

9. Windows 95 fades in business. Companies leapfrog from Windows 3.x to Windows NT on Pentium Pro platforms, bypassing Windows 95. Many will bravely try to force Windows NT onto laptops. Good luck.

10. English moves closer to being the universal language. You can post anything you want on the World Wide Web in any language. But the truth is, the lingua franca of the Internet will continue to be English. Funny how in the second half of this century America has become more of a presence through Disney World and Levi's—and now, online content—than through political or military might. □

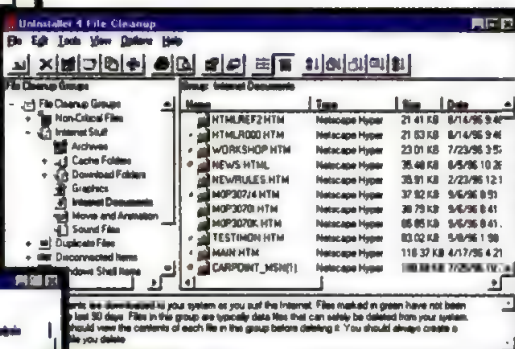
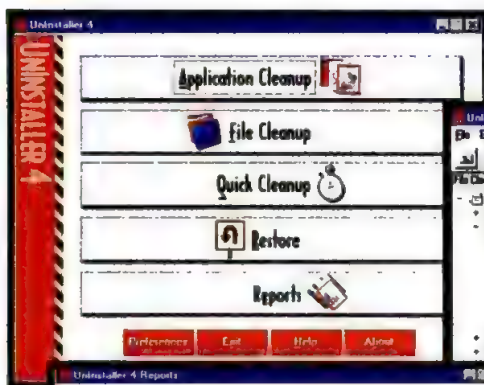


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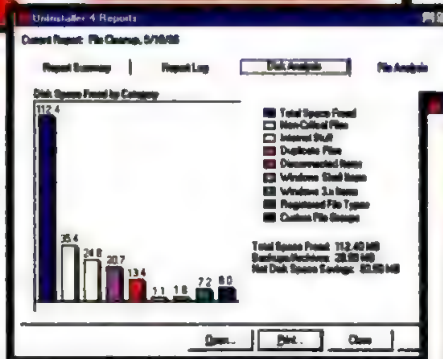
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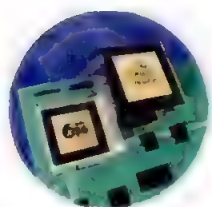
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Our annual best-of-the-year issue is one of our favorite projects. Through countless meetings, e-mails, and postings in a special Lotus Notes discussion database, we spend many

weeks debating the merits of the hundreds of products we've seen during the past year. Through this process, we narrow the list to the few dozen that most impressed the senior editorial and lab staff and the contributing editors of *PC Magazine*.

Even better, compared with our deliberations for the Awards for Technical Excellence (announced in our issue of December 17, 1996), which recognize products of special innovation or technical breakthrough, our con-

sideration as to the best products of the year is not governed by rules of objectivity or unbiased analysis. Although we start our discussion by looking at the many products we've tested throughout the year (particularly those that received our Editors' Choice awards), the products about which you'll read here are, in the end, the ones we flat-out liked the best.

In many cases, these are the products we easily recognized as the strongest in their categories. In other in-



stances, we bickered about the new hardware and software that we've adopted for our individual work. But while we happily struggled to reach consensus on which products to honor here, we all readily agreed that 1996 was a very good year for hardware, software, and networking products. (For the ten best entertainment and educational CD-ROMs of 1996, turn to the After Hours section in this issue.)

We won't proclaim 1996 as the "year of the Internet," if only because we suspect every year in the foreseeable future will vie more convincingly for that honor. Yet unquestionably, Internet tech-

nologies and products dominated this past year.

Last year we managed to scrape together a single Internet-related category, honoring both the best online service and the best Web browser in 1995. This year, 7 of the 30 product categories are specific to the Internet, and many of the others include products with Internet features—just one more reminder that looking back is often the best way to see the future.

Finally, we know that we'll hear some dissenting opinions from readers. We look forward to the feedback: After all, why should we have all the fun?

By Jake Kirchner



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HOME PCs

Gateway Destination Big Screen PC

Gateway 2000 wants you to believe that when you use its **Gateway Destination Big Screen PC**, you've come to the right place for your home computing and entertainment needs. Believing is easy.

The most distinguishing feature of this \$3,299 (direct prices range from \$2,999 to \$3,599) 166-MHz system is its 31-inch VGA monitor, which is perfect for watching television or surfing the Internet. The STB/Brooktree TV/VGA video card features a 125-channel TV tuner, wavetable sound support, and audio jacks for connecting to a stereo. For input devices, there's a wireless keyboard and Field Mouse remote control. And a big bundle of home-oriented software adds even more to the system's appeal. —Robert S. Anthony

Gateway 2000 Inc., North Sioux City, SD; 800-846-2000, 605-232-2000; www.gw2k.com. (Reviewed: June 11, 1996, page 39.) Circle 450 on reader service card.



Toshiba Infinia 7200

One look at the \$3,550 (street price) **Toshiba Infinia 7200** tells you you're in for a unique experience. Its sharp looks, integrated TV and radio tuners, remote control, and use of Universal Serial Bus (USB) technology are all head-turners.

The Infinia line focuses on ingenuity. The 11-button In-Touch module, a USB device (available in LED and LCD versions), connects neatly to the multimedia monitor, which boasts built-in speakers and a subwoofer. The module can control the TV tuner, radio, CD-ROM drive, voice mail, volume, and other functions. And Infinia delivers on the PC front: A Pentium/200 CPU, 32MB of RAM, 3GB of hard disk space, and a speedy 8X CD-ROM drive will serve you well. —RSA

Toshiba America Information Systems, Irvine, CA; 800-334-3445; www.toshiba.com. (Reviewed: December 17, 1996, page 206.) Circle 451 on reader service card.



PENTIUM PRO WORKSTATIONS

HP Vectra XU Series

Move over, Pentium: 1996 was the year that serious processing power arrived on the x86 platform by way of the Pentium Pro. Our favorite of the year was the **HP Vectra XU Series** from Hewlett-Packard Co., a box filled not only with Pentium Pros but with innovation as well.

HP hit the ground running early in the year with the HP Vectra XU 6/150. Its most exciting feature, an HP-designed and manufactured motherboard, was not only the first to support two Pentium Pro CPUs; it was also the first on this platform (and still one of the very few) to use four-way, interleaved DIMM ECC RAM, which allows for a superwide 128-bit memory path.

Although HP has supplanted the 150-MHz version since we tested it with 180- and 200-MHz machines (street prices start at \$3,880 and \$4,000, respectively), these latest releases include everything found in the 150, plus more hard disk space. —RSA

Hewlett-Packard Co., Palo Alto, CA; 800-752-0900, 303-635-1000; www.hp.com. (Reviewed: February 6, 1996, page 39.) Circle 454 on reader service card.



PENTIUM PCs

Dell Dimension XPS

If your budget begs for an entry-level price, but you need a PC with more than entry-level muscle, take a good look at the **Dell Dimension XPS** line. The winners range from a \$2,379 (direct price) Pentium/133 to a \$3,789 (direct) Pentium/166. Note that this line now includes a \$3,179 (direct) unit with a 200-MHz Pentium CPU, SDRAM, and an 8X CD-ROM drive.

If there's a hot new component on the market, it's likely that you'll find it first in a Dimension XPS. For example, by the time you read this, Dell will offer models with high-speed (7,200-rpm), 4GB Ultra Wide SCSI hard disks—at the same price as similar old models with 2GB Fast SCSI hard disks. —RSA

Dell Computer Corp., Austin, TX; 800-388-8542, 512-338-4400; www.dell.com. (Reviewed: June 25, 1996, page 139.) Circle 452 on reader service card.



Micron Millennia Series

Whether you need basic computing or top-level power, you'll find an impressive Pentium PC from Micron Electronics to suit your needs—from the midrange \$2,697 **Micron Millennia 133** to the high-end \$2,956 **Micron Millennia 166**.

Micron machines have always offered top-level performance, and 1996's crop was no exception. Millennia machines are also traditionally on the cutting edge in terms of components: Micron was one of the first vendors to offer 128-bit Number Nine Imagine 128 Series II graphics adapters, as well as 12X CD-ROM drives and Ultra SCSI hard disks on the high end. —RSA

Micron Electronics Inc., Nampa, ID; 800-388-6334, 208-893-3434; www.mei.micron.com. (Reviewed: June 25, 1996, page 152.) Circle 453 on reader service card.



Our Contributors: JAKE KIRCHNER is the editor of *PC Magazine*. DON WILLMOTT is an executive editor and BEN Z. GOTTESMAN and LARRY SELTZER are technical directors at *PC Magazine*. FRANK J. DERFLER, JR., is the senior networking editor, LEON ERLANGER and THOMAS MACE are senior editors, LANCE N. ULANOFF is a senior associate editor, TODD SPANGLER is an associate editor, and JEFFREY G. WITT is a project leader at *PC Magazine*. TONI KISTNER, DAVID LIDSKY, SARAH L. ROBERTS, and MICHELLE SCHOENUNG are staff editors, and ROBERT S. ANTHONY is a senior writer at *PC Magazine*. JIM SEYMOUR is a contributing editor at *PC Magazine*. YVONNE KOULOUTHROS was the staff editor in charge of this story.



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PDAS



Pilot

Running on two AAA batteries, weighing just 5.5 ounces, and measuring just 4.7 by 3.2 by 0.7 inches (HWD), the **Pilot** (\$370 street price), from U.S. Robotics, is a hand-held computer that makes sense. It has a 3.4-inch monochrome screen and comes with a unique cradle that attaches to your desktop PC via a dedicated serial port. You can gather information all day in the Pilot's date book, address book, to-do list, or memo pad. When you get back to the office, you simply put the gadget in the cradle and press the HotSync button, and within seconds, all the data is in your PC.

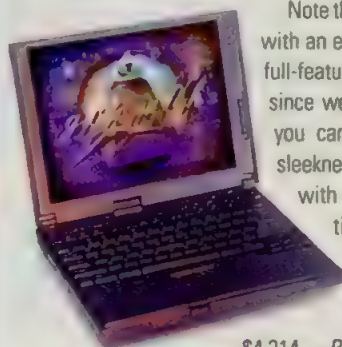
The Pilot's software can be equipped with translation facilities for popular information managers such as ECCO, Lotus Organizer, and Sidekick. In addition, the Pilot includes a handwriting-recognition technology called Graffiti. You can also touch-type with the stylus on an on-screen keyboard. All in all, the Pilot was one of our favorite new traveling companions in 1996.—*Don Willmott*
U.S. Robotics, Mountain View, CA; 800-881-7256, 415-237-6000; www.usr.com/palm. (Reviewed: May 14, 1996, page 42.) Circle 469 on reader service card.

PORTABLE PCs

IBM ThinkPad 560

The notebook market saw a lot of action in 1996, from 12.1-inch displays and systems weighing under 5 pounds to mass acceptance of integrated CD-ROM drives.

On the lightweight side of the fence, our favorite over this past year was the \$3,750 (street price) **IBM ThinkPad 560**. How much power can IBM squeeze into a tiny package? Inside this 4.8-pound portable lives a 12.1-inch active-color display, a 120-MHz Pentium CPU, 16MB of RAM, a 774MB hard disk, and a full-size keyboard. Amazingly, it's just 1.3 inches thick.



Note that IBM came out with an even faster, more full-featured ThinkPad 560 since we tested it: Now you can get the same sleekness and portability with a 133-MHz Pentium CPU, 16MB of RAM, and 1GB of hard disk space for

\$4,314.—*RSA*

IBM Corp., Armonk, NY; 800-426-2968, 914-766-1900; www.ibm.com. (Reviewed: August 1996, page 178.) Circle 476 on reader service card.

IBM ThinkPad 760ED

If you can't afford to leave top-level processing power behind when you hit the road but can afford \$5,400 (street price), the **IBM ThinkPad 760ED** is the portable muscle machine for you. With a 133-MHz Pentium CPU, 1.2GB of hard disk space, a 12.1-inch SVGA TFT black-matrix display, and a 64-bit Trident 9385 graphics chip set, this unit is an 8.1-pound (travel weight) powerhouse.

The unit also features a keyboard that tilts up as you open the case, two infrared ports, a 4X CD-ROM module that you can swap for a floppy disk drive, NTSC video-in and video-out ports, and a software-upgradable IBM Media Processor that serves as a 28.8/14.4-Kbps data/fax modem. Since we tested



the 760ED, IBM has produced a \$6,000 (street price) model with a 12.1-inch XVGA display, 2.1GB of hard disk space, and a 6X CD-ROM.—*RSA*

IBM Corp., Armonk, NY; 800-426-2968, 914-766-1900; www.ibm.com. (Reviewed: August 1996, page 178.) Circle 476 on reader service card.

APPLICATION SERVERS

Compaq ProLiant 5000 6/200

The quad-CPU Pentium Pro server arrived in the fall of 1996 amid much fanfare. Our favorite in this new category was the \$44,190 (street price) **Compaq ProLiant 5000 6/200**.

Setting up the ProLiant can be easy, if you use Compaq's stellar SmartStart configuration software. Add the vendor's Insight Manager software, and you can take the pain out of managing this robust unit. Among Insight Manager's many features are



asset tracking of network devices and monitoring of server vital signs, including CPU usage and system temperatures. For out-of-band management, Compaq offers its Remote Insight board, which will page you in the event of hardware failure. Two key Compaq-designed components in the system are the

vendor's Smart-2 Array PCI RAID controller and its Netelligent dual-ported Fast Ethernet adapters.—*RSA*

Compaq Computer Corp., Houston; 800-345-1518; www.compaq.com. (Reviewed: October 22, 1996, page 215.) Circle 470 on reader service card.

FILE SERVERS

HP NetServer 5/133 LH

With excellent design, performance, functionality, and a mature management solution in its NetServer Navigator, the \$8,000 (street price) **HP NetServer 5/133 LH** is a network administrator's dream.

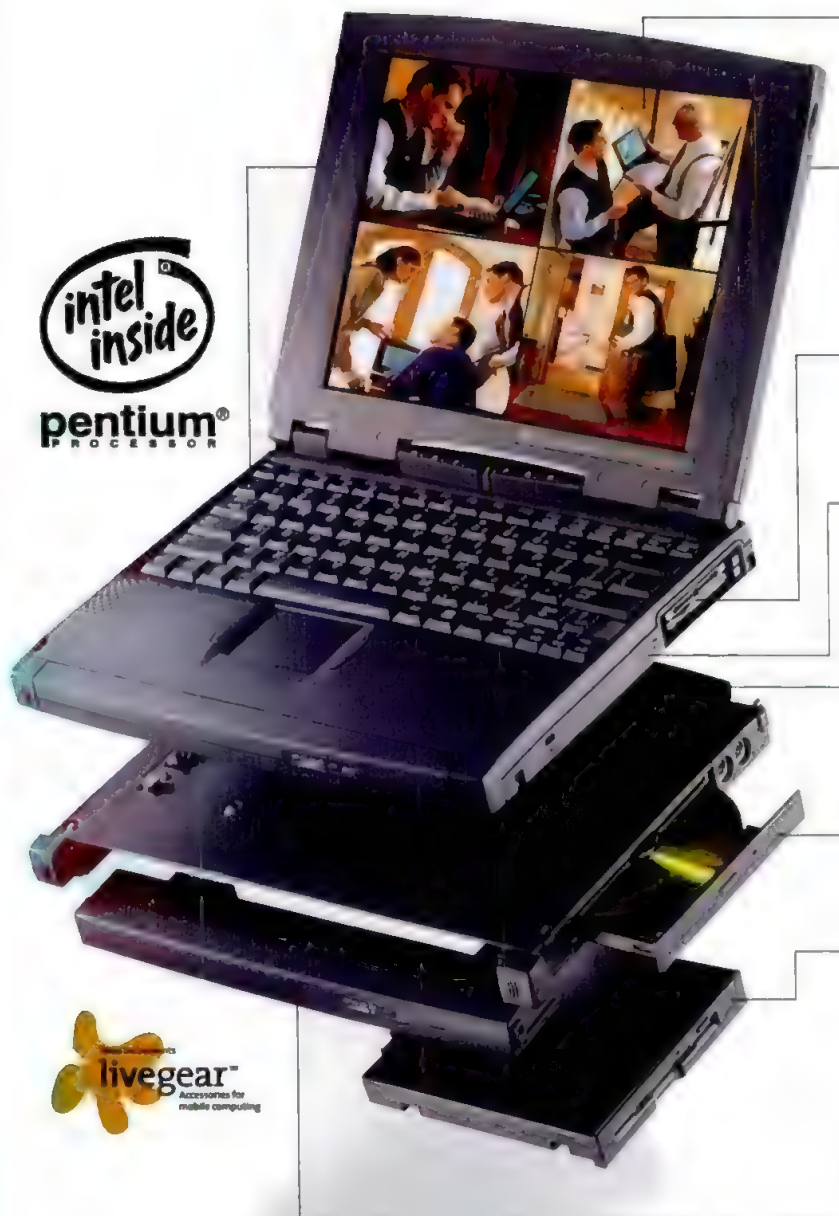
Two outstanding features are the bridged PCI-bus architecture (which affords five PCI slots) and the dual integrated Fast SCSI adapters, which let you duplex the NetServer's disk subsystem right out of the box. Add its six hot-swappable drive bays, standard ECC RAM, and SMP support and you have a server that's ready for some serious work.

Managing the NetServer couldn't be easier, whether you're in front of its console or not. With HP's NetServer Navigator, you can monitor the server's internal vital signs and devices on your network from a remote site by dialing into the server via phone.—*RSA*

Hewlett-Packard Co., Network Server Division, Santa Clara, CA; 800-322-4772; www.hp.com/go/netserver. (Reviewed: March 26, 1996, page 170.) Circle 454 on reader service card.



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- 8:05AM** – “Help me out, Tom. The Engineering VP wants to copy our schematics this morning. Can you take your notebook there and use your Fast Infrared port?”
- 8:22AM** – “Mr. Lawson, just a reminder, 9:30 video conference with the Frankfurt office. They received the spreadsheets you e-mailed yesterday.”
- 8:34AM** – “Thanks for those schematic files, buddy. By the way, your new notebook’s under 5 pounds and mine’s almost 9. You’re giving me 4 strokes on the golf course, pal.”
- 9:17AM** – “Lawson, the CIO says 100BaseT Fast Ethernet is the way to go for our new office downtown. Your new notebook can access the network easily.”
- 10:15AM** – “Tom, the data you need is on multimedia CD. Bring your notebook to Marketing.”
- 10:33AM** – “Guten Morgen, Thomas. Very good conference call this morning. Sales are up as your analysis predicted. The spreadsheets really helped.”
- 11:30AM** – “Tom, this is the Chairman. Great presentation. You’re going to our test site in the Mojave Desert with the Engineering VP, my friend. It’s a full day of meetings, so bring an extra battery and a sleeping bag. There’s no electricity.”



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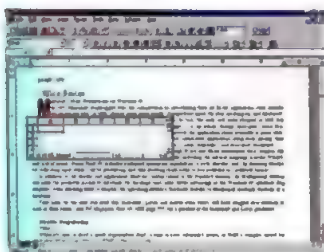
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SUITES



Microsoft Office Professional for Windows 95

In 1995, Microsoft leapfrogged over the competition by introducing its 32-bit application suite months before anyone else. In 1996, change came more slowly. Competitors spent the year catching up, and at press time, Microsoft had not yet shipped a new version of its Office suite. In fact, the only new suite shipped was Corel's WordPerfect Suite 7 (with its Professional 7 counterpart). Still, at press time, **Microsoft Office Professional for Windows 95** (\$600 street price) stands above the other suites available.

Besides the 32-bit environment throughout all its programs—including Word, Excel, PowerPoint, Access, Schedule+, and Microsoft Bookshelf—Office Professional 95 introduced an unmatched integration of applications. In addition to the Binder application and the Shortcut toolbar found in the standard version, the Professional version provides the powerful Access 95 database. No database tool takes better advantage of the Windows 95 interface. But by the time you read this, Microsoft, Lotus, and maybe even Corel may have shipped new versions of their application suites.—*Lance N. Ulanoff*
Microsoft Corp., Redmond, WA; 800-426-9400, 206-882-8080; www.microsoft.com. (Reviewed: October 10, 1995, page 38.) *Circle 456 on reader service card.*

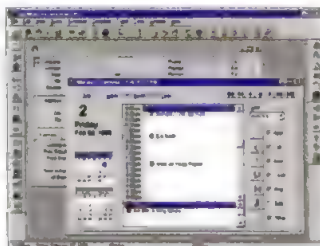
INFORMATION MANAGERS

Contact-centric:

GoldMine for Windows 95

Both 95 (the OS) and '96 (the year) proved favorable for GoldMine Software. The product's smooth move to a fully compatible Windows 95 version produced another winner, with an improved interface, a report generator, and intelligent Internet e-mail support.

Like its prior versions, **GoldMine for Windows 95** (\$295 list price) offers powerful contact management tools, including tools for handling very large, linked contact lists via groups and folders. And this version introduced InfoCenter, a knowledge-base system somewhat like the Windows help system. But the new Internet e-mail and synchronization abilities most impressed us. To contact users with Internet e-mail addresses, you can send them e-mail from the application.—*LNU*



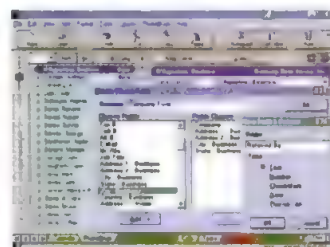
GoldMine Software Corp., Pacific Palisades, CA; 800-654-3526, 310-454-6800; www.goldminesw.com. (Reviewed: April 23, 1996, page 180.) *Circle 474 on reader service card.*

Information-centric:

ECCO Pro 3.0

With 1996's **ECCO Pro 3.0** (\$139 list price), NetManage successfully added more traditional features for personal information management. For example, this version has interfaces for managing contacts, schedules, and calendars, to accompany ECCO's well-known folder metaphor.

Thanks to the folder system, ECCO Pro remains a powerful free-form information manager. The contact record provides plenty of boilerplate and user-defined fields. You can link the contact data to your word processor to perform mail-merges. And scheduling is a drag-and-drop operation.



The Shooters tool, which lets you move information between ECCO and any Windows application, has always impressed us. In 1996, NetManage took it to the next level, allowing us to use it with Web browsers.—*LNU*

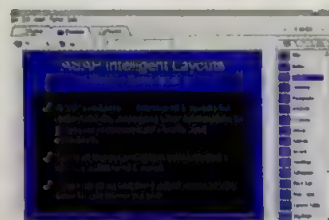
NetManage Inc., Bellevue, WA; 800-457-4243, 206-885-4272; www.netmanage.com. (Reviewed: April 23, 1996, page 179.) *Circle 484 on reader service card.*

PRESENTATION GRAPHICS

ASAP WordPower

For its first version of ASAP, Software Publishing Corp. deliberately designed it as a simple presentation-graphics program, devoid of features geared toward creating complex, multimedia-filled presentations. We were rather impressed with the result: the fastest, easiest, most efficient product in this category.

SPC has since released a second version, **ASAP WordPower** (\$100 street price), which retains the first version's nifty Intelligent Formatting, a feature that adapts your files seamlessly into very visual slides and reports. You build a simple outline either in ASAP or in a word processor, point and click a couple of times, and voilà! you have an attractive, intelligently designed presentation. This version offers Windows 95 compliance, more transitions, and enhanced layout features.—*Yvonne Kaulouthras*

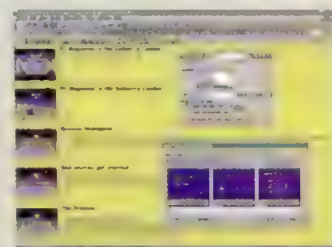


Software Publishing Corp., San Jose, CA; 800-336-8360, 408-537-3000; www.spc.com. (Reviewed: April 23, 1996, page 75.) *Circle 488 on reader service card.*

Lotus Freelance Graphics 96

With **Lotus Freelance Graphics 96**, Lotus established itself as the leader in complex presentation graphics. The hand-holding help in Freelance 96 (\$360 street price) is almost an art form. For example, when you want to change an object, the Infobox properties box makes it easier than ever before. And the outliner tool now lets you view readable thumbnails concurrently with the indented text, clarifying a sometimes confusing procedure.

In addition, the use of Lotus's TeamReview gives unique feedback; its annotation, routing, and consolidation features remain unparalleled. Lotus has also updated Freelance 96's clip-art collection and has created truly intelligent SmartMasters that finally include much-needed built-in transitions and animations.—*YK*
Lotus Development Corp., Cambridge, MA; 800-343-5414, 617-577-8500; www.lotus.com. (Reviewed: March 12, 1996, page 220.) *Circle 478 on reader service card.*



Jim Seymour's Thumbs Up, Thumbs Down of 1996

THUMBS UP Congrats and thanks to Corel, which bought ailing WordPerfect for a song from the fire sale that was Novell, whipped into shape a very good 32-bit Version 7 for Windows 95 in record time, and delivered it at prices that crushed Lotus SmartSuite sales and scared the hell out of Microsoft. Good product, great price, another Indiana-Cowpland-to-the-rescue story.

THUMBS UP/THUMBS DOWN *Deathwatch 1.0*: Years late, Pinnacle Micro finally shipped the Apex, its 4.6GB optical drive—but with high-performance, \$99 1GB Jaz cartridges everywhere, is there still a market for the Apex?

THUMBS OUT *Landed on his feet*: Jim Manzi.

THUMBS UP Compaq started putting two-line modems in some of its Presarios—a long-overdue move for the many home-office users who want both data/fax and voice-telephony connections on their PCs.

THUMBS OUT *Landed, for now*: Philippe Kahn.

THUMBS UP/THUMBS DOWN In the year when presidential politics went online, we saw too much pap foisted off as serious analysis. Some of the spoof sites were okay, though, and the Time/CNN AllPolitics site (www.allpolitics.com/) deserves an award for setting a high standard for straight reporting.

THUMBS DOWN Sony's me-too VAIO, supposed to be its hot entry into the home-PC market, turned out to be an also-ran, an embarrassing placeholder for the company's real entry into the market in spring 1997.

THUMBS OUT *Landed back in California*: Bob Frankenberg.

THUMBS DOWN *Deathwatch 2.0*: Lotus put off delivery of the 32-bit version of what we used to call its flagship program—1-2-3—to 1997, a year and a half after Win 95 arrived. Better late than never, sure, but there are limits to customers' patience. Limits reached before this one arrived. By now even



Lou Gerstner probably uses Excel.

THUMBS UP *Nice job, Toshiba*: Building all those great portables turned out to be the right kind of preparation for entering the home-PC/desktop-PC market. Toshiba's Infinia 7200 is proving to be a head-turner, with the right mix of features, price, high-concept looks, and sass.

THUMBS DOWN AT&T, having bought and wrecked NCR and having introduced and then abandoned lines of PCs twice—losing untold billions in the process—managed in 1996 to get the Internet business wrong, too. AT&T's WorldNet service quickly fizzled as the company couldn't handle potential subscribers' calls, then couldn't handle the business of those who did sign up.

THUMBS UP/THUMBS DOWN *Deathwatch 3.0*: IBM finally sounded taps, of sorts, for OS/2, when exec John Thompson said that the newest release of Warp was for those folks who had committed to it and couldn't back out.

THUMBS DOWN Intel backed off on a Q4 release of its much-ballyhooed MMX CPUs because it couldn't get good run rates on 200-MHz parts, it says. But just coincidentally, that let Intel duck customers' complaints that it was confusing the market and hurting sales by dropping a supposedly big-deal

processor on the market right in the middle of the Christmas home-PC buying season. Even though we've been able to test only one engineering sample of the MMX system on the single MMX-aware app available in the fall (Adobe PhotoDeluxe), we were underwhelmed by the performance boost—nothing like the 50 to 400 percent improvement that Intel projects. Ship no silicon before its time, and all that.

THUMBS DOWN Memo to Steve Case, America Online honcho: Just three numbers to watch here, Steve, just three. You spent \$270 to get each new subscriber in the most recent quarter, for a business which charges \$9.95 a month and sees 25 percent of its subscribers bail out every year. Not good economics, Steve. And moving to the New York Stock Exchange isn't going to make the investment community wink at those numbers much longer.

THUMBS DOWN *Deathwatch 4.0*: AMD and Cyrix both failed to persuade PC manufacturers to adopt their Intel-wannabe CPU chips. How much longer will either be considered a serious contender in the CPU races?

THUMBS DOWN Microsoft, ever ready to send its customers home singing, sent an especially nice new demo CD-ROM from Network + InterOp home with them. Unfortunately, it had the Was virus embedded in it. Wonder what song those customers were singing when the problems started back home?

THUMBS DOWN *Deathwatch 5.0*: Apple has no competitive notebooks. It faces faster and cheaper clones from Power Computing and maybe even Moto, and now System 8/Copland has become a Stephen King serialized novel: Buy it by the episode at the supermarket check-out counter.

THUMBS OUT *Landed in jail*: DVD optical disks.

THUMBS UP Many vendors are offering \$500 CD recorders. (But has the Web so captured our imagination—as well as our time—that CD-ROMs are old hat already?)

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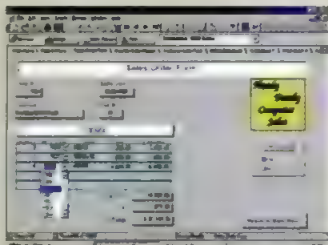
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END-USER DATABASES

Lotus Approach 96 for Windows 95

Easy and database are two words you'd never expect to hear in the same sentence. That is, until Lotus Development Corp. released **Lotus Approach 96 for Windows 95** (\$110 street price). Approach makes excellent use of its tabbed interface, giving you instant and constant access to your forms, data worksheets, crosstabs, and reports.



What's more, this 32-bit version remains compatible with earlier versions, so you can bring your old Approach files into this more intuitive interface. As in other Lotus SmartSuite 96 applications, the intelligent Infobox is omnipresent, and the Action Bar keeps commonly used menu items a mouse click away. Impressively, all this ease makes Approach no less powerful or speedy than its competitors. —LNU

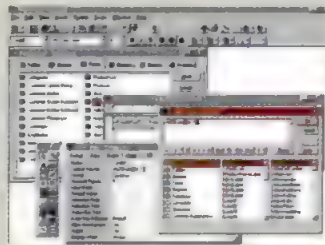
Lotus Development Corp., Cambridge, MA; 800-426-7682, 617-577-8500; www.lotus.com. (Reviewed: May 28, 1996, page 138.) Circle 478 on reader service card.

Microsoft Access for Windows 95

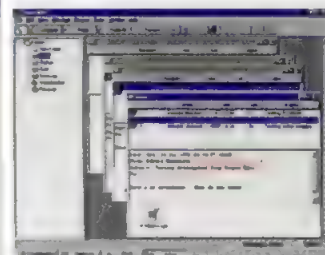
The most powerful end-user database product available today, **Microsoft Access for Windows 95** (\$340 street price) includes helpful, practical Wizards to shield users from much of its complexity. But a lot of power rumbles under its friendly surface: Access can grow with your abilities—all the way up to database programming with Visual Basic for Applications.

To help new users get into databases, Access keeps all the parts of your database in a single easy-to-manage file. And no other database product takes better advantage of Windows 95. Access can keep multiple versions of your database (the one on your desktop, the one on your laptop) in synch via Windows 95's Briefcase replication feature. —YK

Microsoft Corp., Redmond, WA; 800-426-9400, 206-882-8080; www.microsoft.com. (Reviewed: May 28, 1996, page 146.) Circle 456 on reader service card.



INTERNET E-MAIL CLIENTS



Pronto 96

Believe it or not, not everyone is using one of today's two most popular browsers—Netscape Navigator and Microsoft's Internet Explorer—to manage their Internet e-mail. Some use browsers that don't come with e-mail clients, and others just need a way to exchange e-mail and have no interest in browsing. They can choose from a multitude of options, but the one we liked best this past year was CommTouch Software's **Pronto 96** (\$59 list price).

This elegant, 32-bit POP-based e-mail client offers one of the most effective rules-based message handling systems available in independent Internet e-mail tools. What's more, it features an intelligently designed interface that isn't bad to look at, either.

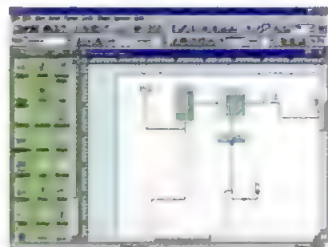
This interface includes a unique message-preview pane, as well as tools that you normally expect to find in standard VIM- and MAPI-based e-mail clients: wizards, drag-and-drop operations, automated replies, and double-click launching of attachments. As with many Internet e-mail clients, the address-book management could use some additional work. But we expect to see improvements in the coming months. —LNU

CommTouch Software Inc., Sunnyvale, CA; 800-638-6824, 408-245-8682; www.commtouch.com. (Reviewed: October 8, 1996, page 202.) Circle 455 on reader service card.

BUSINESS DIAGRAMMING

Visio 4.0

Since Visio Corp. first introduced Visio in 1992, its combination of intelligent shapes, smart connection tools, and data-driven objects have made it the most flexible and powerful—yet easy-to-use—business diagramming tool available today. The addition of wizards, improved drawing tools, three-dimensional perspective, and support for the Windows 95 Binder make **Visio 4.0** (\$249 list) even more powerful and useful than ever before.



Visio's SmartShape symbols, customizable image libraries with user-configurable drag-and-drop functionality, make creating diagrams quick and intuitive. Considering how much data can be stored behind the shapes, simplifying the building of intelligent diagrams—like a complex org chart or a layout of fire hydrants in a metropolitan city—is no mean feat. —LNU

Visio Corp., Seattle; 800-446-3335, 206-521-4500; www.visio.com. (Reviewed: February 6, 1996, page 188.) Circle 489 on reader service card.

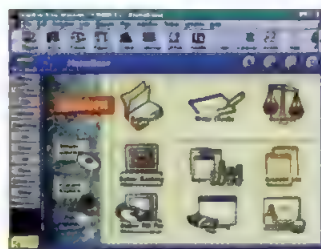
PERSONAL FINANCE

Quicken Deluxe 5 for Windows

Short of what your own financial advisors may tell you, no personal finance guidance can compete with what Intuit's **Quicken Deluxe 5 for Windows** (\$60 street price) offers. Quicken makes electronic financial management a snap via 36 partnerships with banks, enabling you to access your account directly from your PC.

Quicken comes with Tax Link Assistant, a transition tool that lets you move your financial records smoothly from their individual Quicken categories into the proper line items found in Intuit's TurboTax. Deluxe 5 offers Easy-Answer Reports, the new HomeBase, better investment tracking, and intelligent multimedia-based advice. At press time, Intuit had just released Quicken Deluxe 6 for Windows (\$60 street price), which has Internet-related features, a debt-reduction planner, and in-depth Show Me instructions. —YK

Intuit Inc., Mountain View, CA; 800-446-8848, 415-944-6000; www.intuit.com. (Reviewed: January 23, 1996, page 340.) Circle 477 on reader service card.





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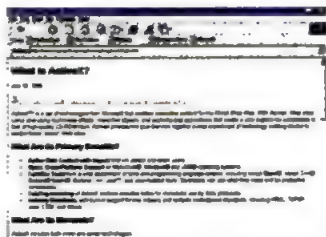
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INTERNET BROWSERS

Microsoft Internet Explorer 3.0

The new **Microsoft Internet Explorer 3.0** has transformed Microsoft's once-weak browser into a top-notch surfing machine. It's well designed, intuitive, and free for anyone to download. Internet Explorer not only matches the features of Netscape's Navigator 3.0 browser (including HTML frames, Java, and integrated mail and news), but it impressively strikes out in interesting, new directions.



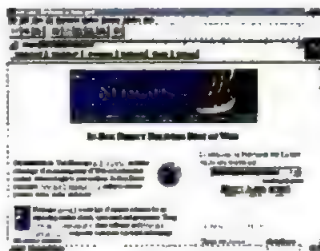
Internet Explorer 3.0 introduces ActiveX controls—program building blocks that can be assembled into applications—as an important new Web standard. Other big innovations include Internet Explorer's support for advanced HTML features such as cascading style sheets, and its integrated NetMeeting collaboration tools that let you talk and share Windows applications across the Internet.—*Thomas Mace*

Microsoft Corp., Redmond, WA; 800-426-9400, 206-882-8080; www.microsoft.com. (Reviewed: October 22, 1996, page 100.) Circle 456 on reader service card.

Netscape Navigator 3.0

The world's most popular and influential browser, **Netscape Navigator 3.0** (\$49 list price) still sets the standard that its competitors must meet. Navigator supports a host of widely used enhancements to HTML, including frames. And its built-in Java support lets you make use of the wealth of Java applets now on the Internet.

Navigator's plug-in architecture, which lets you add new capabilities to the browser on the fly, has triggered an explosion of cool audio, video, multimedia, and other special formats on the Web. A clear interface, easy-to-use controls, and a straightforward setup also add to this browser's appeal. And as if browsing weren't enough, Navigator includes e-mail and news programs, an Internet telephone, and the CoolTalk collaboration program.—*TM*



Netscape Communications Corp., Mountain View, CA; 800-638-7483, 415-937-3777; home.netscape.com. (Reviewed: October 22, 1996, page 100.) Circle 457 on reader service card.

INTERNET TOOLS

NewsCatcher

"Hey, what's that little black pyramid on your desk?" That's a question many people hear these days, and the answer is Global Village Communication's **NewsCatcher** radio receiver. Using the AirMedia Live Internet Broadcast Network, NewsCatcher (\$150 street price) brings you everything from headlines and stock quotes to movie reviews and lottery numbers in good-looking, easy-to-use frames.

The first year of basic service comes free; \$5.95 a month more buys the Premier service, which gives you more content as well as more frequent updates. For \$9.95 a month (after an initial 90 days free), Global Village offers the Premier service plus a notifier that tells you when you've received e-mail.—*DW*

Global Village Communication Inc., Sunnyvale, CA; 800-736-4821, www.globalvillage.com. (Not previously reviewed.) Circle 473 on reader service card.

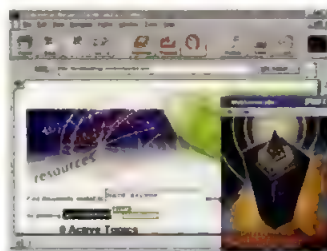


WebCompass 1.0

For industrial-strength Web search capabilities, both on- and off-line, look to **WebCompass 1.0**. Searches can begin in the database of topics or with a keyword search. The product's agent technology eliminates duplicate results and provides you with a list of findings and a summary of each site.

Every feature is customizable, and WebCompass (\$80 street price) also includes its own browser, server, and HTML-based interface. Keep in mind that Quarterdeck has recently released version 2.0 (\$50 street price), a multithreaded, multsocket application that, among other features, provides you with the ability to call more than 40 search engines.—*DL*

Quarterdeck Corp., Marina Del Ray, CA; 800-354-3222, 310-309-3700; www.qdeck.com. (Reviewed May 14, 1996, page 210.) Circle 485 on reader service card.



OFF-LINE BROWSERS



WebEx

A fast, sophisticated off-line browser that lets you store pages while you surf or schedule downloads for later, Traveling Software's **WebEx** (\$29.95 list price) can get you what you want on the Web when you want it.

You are able to specify the depth of searches within a site and tell WebEx whether to save graphics, text, or multimedia files. The WebEx Agent automatically configures itself as a proxy server for your browser, whether you're using Microsoft Internet Explorer or Netscape Navigator.

WebEx works almost exclusively within your Web browser. Through a forms-based interface, you set preferences for downloading and scheduling, including the maximum download size. When you select a downloaded site to view, WebEx creates a table of contents for you that lists either all pages on the site or only the unread ones.

And since we last reviewed WebEx, Traveling Software has released its second version of the product, Version 1.02, with an added bonus: a free two-month subscription to the Wall Street Journal Interactive Edition.—*David Lidsky*

Traveling Software, Bothell, WA; 800-343-8080, 206-483-4088; www.travsoft.com. (Reviewed: August 1996, page 44.) Circle 458 on reader service card.

THE CLEAR CHOICE



EDITORS' CHOICE

When it comes to buying a monitor, choose a winner. Choose a ViewSonic®.

Consider, for example, the Optiquest V775 Value Line Monitor by ViewSonic. We set out to prove that a 17" (16.0" viewable) monitor can deliver high performance (0.26mm dot pitch and 1,600 x 1,200 maximum resolution), a powerful feature set, and full compatibility with PCs and Macs® — all at an affordable price.

We succeeded. After rigorous tests and evaluations, the editors of PC Magazine wrote that the V775 is "a competitive monitor that offers bright, rich colors and sharp images."



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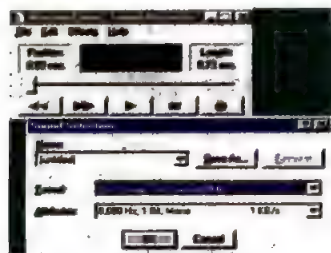


CIRCLE 117 ON READER SERVICE CARD OR GO TO WWW.PCMAG.COM/ProductLink

WEB-BASED AUDIO

TrueSpeech Internet

One of the few audio technologies on the Web that truly stands out, **TrueSpeech Internet** is a family of codecs built to enable high-quality audio transmission across low-bandwidth Internet connections.



1, delivering a clear audio stream through 14.4-Kbps or faster modems.

TrueSpeech not only does a fine job with speech but even handles music quite well, a tough challenge for any low-bandwidth compression system. Version 8.5 is licensed by Microsoft and built into Windows 95 Sound Recorder. Even better, you can download the TrueSpeech player from DSP Group's Web site for free. —*TM*

DSP Group Inc., Santa Clara, CA; 408-986-4300; www.dspg.com. (Reviewed March 26, 1996, page 125.) Circle 459 on reader service card.

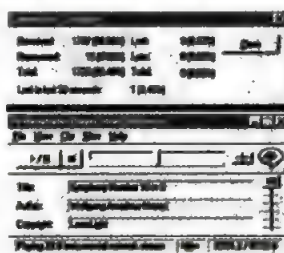
RealAudio

The most popular audio format on the Web by an overwhelming margin, **RealAudio** provides an elegant—and free—audio player, solid codecs and encoding tools, and industrial-strength RealAudio server products that can deliver streaming audio to hundreds of users at once.

RealAudio content on the Web runs the gamut from news and politics to alternative rock delivered from a host of big-name content providers. With about 10 million RealAudio players on the Web, the amount of RealAudio content can only grow. The latest release, RealAudio 3.0 Plus, adds several new codecs that can deliver stereo over a 28.8-Kbps modem or stream FM-quality sound through ISDN and faster connections. And RealAudio Plus (\$25 street price) includes extra features such as the ability to scan channels and save favorite channels. —*TM*

Progressive Networks Inc., Seattle; 206-447-0567;

www.realaudio.com. (Reviewed March 26, 1996, page 113.) Circle 460 on reader service card.



LCD PROJECTORS



Lightware Viewpoint 100

Good news for road warriors: LCD projection panels are lightweight, but if you've ever relied on one for an off-site presentation, you know how it feels to be at the mercy of an ancient overhead projector with a light source that turns your crisp PowerPoint graphics to a pastel blur.

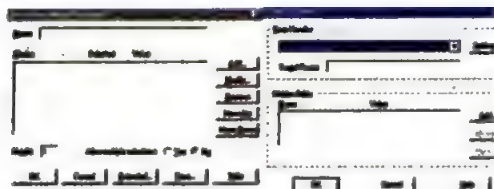
But the new breed of LCD projectors is sure to make those memories easy to repress. LCD projectors now combine the light source of the overhead projector with the color display of an LCD panel.

Out of the bunch that passed through our hands, the **Lightware Viewpoint 100** (\$5,800 street price) stole the show. At about 9 pounds, it weighs roughly half what its nearest rival does, so you'll still travel light. It also includes neat features such as an on-screen "curtain" that lets you cover the screen, as well as an on-screen pointer.

So bigger isn't always better: Despite its small size, the Lightware Viewpoint 100 was one of the brightest projectors we tested and produced crisp, clear images. —*Toni Kistner*

Lightware Inc., Beaverton, OR; 800-255-9469, 503-641-7873. (Reviewed August 1996, page 212.) Circle 461 on reader service card.

WEB AUTHORIZING TOOLS



Microsoft FrontPage 1.1

A powerful Web authoring and site management tool, **Microsoft FrontPage 1.1** (\$149 list price) hides the complexities of HTML by letting you work directly and easily with a WYSIWYG rendition of your page. You can use templates built through wizards to develop the basic elements of a page or a site, and then use the toolbars, menus, and keyboard shortcuts to create links and add images. FrontPage will build a form around any form field you insert.

FrontPage includes canned CGI scripts for some forms-processing functions, and its Personal Web Server can turn your standalone machine into a Web server. FrontPage offers a complete HTML authoring solution that you can use with a minimum of stress and strain. Note that the next version, Microsoft FrontPage 97 (\$149 list price), will be shipping by the time you read this. —*DL*

Microsoft Corp., Redmond, WA; 800-426-9400, 206-882-8080; www.microsoft.com. (Reviewed September 10, 1996, page 152.) Circle 456 on reader service card.

WEB SERVERS

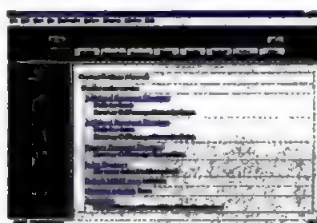
Netscape Enterprise Server

With exceptionally powerful features that enable several people—even whole departments—to share Web-page creation and management tasks, Netscape Communications Corp.'s **Netscape Enterprise Server** (\$995 list price) stands out from the pack.

Enterprise Server, which runs on Windows NT and various flavors of Unix, includes Secure Sockets Layer 3.0 with client-side authentication, an integrated search engine from Verity, SNMP support, excellent database connectivity, and Web site content management, including document check-in and check-out. You'll also find it in Netscape's SuiteSpot

(\$3,995), an Intranet platform that includes news, mail, proxy, directory, and catalog servers. And by mid-1997, Netscape plans to implement the LDAP directory services specification and powerful groupware features. —*Leon Erlanger*

Netscape Communications Corp., Mountain View, CA; 800-638-7483, 415-937-3777; www.netscape.com. (Reviewed September 10, 1996, page 186.) Circle 457 on reader service card.



GRAPHICS ACCELERATORS

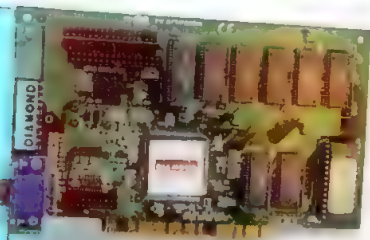
Diamond Stealth 3D 2000XL

If your heart is set on a 3-D graphics card, the **Diamond Stealth 3D 2000XL** (\$180 street price) gives you respectable three-dimensional graphics acceleration and the very best two-dimensional acceleration we've seen. Based on S3's popular ViRGE 2-D/3-D chip, the Stealth 3D beat out all the other accelerator boards we tested during the year on our WinMark 97 and Winstone 97 tests.

Diamond bundles the card with Mediagraphics' MPEG Arcade player, Compton's Interactive Encyclopedia 1996, two 3-D game titles, and its own

InControl Tools 95 software, which allows you to change your screen resolution, refresh rate, zoom, and desktop and viewpoint settings in a flash. You are also able to reset color depth and resolution handily, without rebooting the system. —TK

Diamond Multimedia Systems Inc., San Jose, CA; 800-468-5846, 408-325-7000; www.diamondmm.com. (Reviewed: December 3, 1996, page 291.) *Circle 462 on reader service card.*



MONITORS

MAG DX700T

If you're a CAD or graphics professional, image is your business, so you absolutely need a flawless big-screen monitor. And if you want to impress your boss without blowing the company hardware budget, look to the **MAG DX700T** from MAG Innovation.

For under \$740 (street price), it puts the bright, sharp picture quality that Trinitron tubes are famous for within the reach of mainstream users.

The 0.25-mm-pitch aperture grille tube produced one of the brightest images we've seen, and the unit placed at the top of our overall MonMark test scores.

In 1,024-by-768 mode, the MAG DX700T gives a solid image with an excellent refresh rate of 85 Hz, making it the ideal choice for business users. And what's more, MAG includes a highly detailed owner's manual and a generous three-year warranty. —TK

MAG Innovation, Santa Ana, CA; 800-827-3998, 714-751-2008; www.maginnovation.com (Reviewed: October 8, 1996, page 261.) *Circle 463 on reader service card.*



PRINTERS

Color

Tektronix Phaser 550

If you're hunting for the ultimate color laser printer, put the **Tektronix Phaser 550** (\$6,995 list price) at the top of your list. For printing graphics and photographs on plain paper, with or without black text on the same page, the Phaser 550 is the best printer around. It produces the most superb output we've yet seen from a color laser, in both the 600-dpi and 1,200-dpi modes. Color business graphics are crisp and clear, and images approach true photographic quality.

In addition, the printer is easier to set up than its rivals: Simply slide in the imaging unit, the fuser, and four toner cartridges, and then load the paper and install the driver. The Phaser 550 also proved quite fast: It consistently came in first or second among 600-dpi PostScript laser printers on our tests. And that makes it an intelligent choice for busy users who demand fine color output. —TK
Tektronix Inc., Wilsonville, OR; 800-835-6100, 503-682-7377; www.tektronix.com. (Reviewed: October 22, 1996, page 175.) *Circle 464 on reader service card.*



Network

QMS 2425Ex Print System

So you need a network laser printer that will meet the expectations of your workgroup or department? Well, the **QMS 2425Ex Print System** (\$5,499 list) will fill the bill.

This printer boasts 600-dpi output, a generous 24MB of RAM, 256MB of internal hard disk space, and speedy, flawless paper handling. The machine's Crown Admin2 software makes configuring and controlling printers remotely a cinch, automatically alerts you to errors, and provides you with a common interface across all Windows and Unix platforms.

QMS's Display List lets the printer save jobs to memory, which substantially speeds multicopy printing and cuts network traffic. Also, an automatic recovery feature reprints pages lost in a jam. Other noteworthy options include a MultiRes daughtercard (\$499) to double the output to 1,200 dpi and a combination sorter and stapler (\$1,499). —TK

QMS Inc., Mobile, AL; 800-523-2696, 334-633-4300; www.qms.com. (Reviewed: June 11, 1996, page 212.) *Circle 465 on reader service card.*



Personal

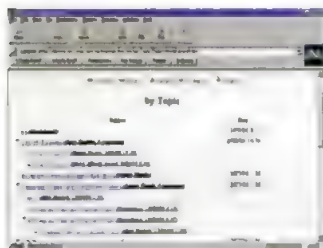
Epson Stylus Color 500

With knockout graphics and low per-page costs, the **Epson Stylus Color 500** (\$329 list) is a great bargain. Epson's piezoelectric ink jet technology offers finer dot control than printers that use thermal technology, and the Stylus Color 500 uses new superpenetrating dye-based black and color inks. For monochrome work (clear and fine gray-scale images), this ink jet rivals any laser printer. For color printing, the Stylus Color 500's output in 720-dpi mode is simply stunning. Epson bundles its new Color Pak, which includes Sierra On-Line's Print Artist and Adobe's fine PhotoDeluxe image-editing software. All in all, this ink jet printer is one tough act to follow. —TK

Epson America Inc., Torrance, CA; 800-463-7766, 310-782-0770; www.epson.com. (Reviewed: November 5, 1996, page 120.) *Circle 466 on reader service card.*



GROUPWARE



Lotus Notes Release 4.1 with Domino

To those of you who thought the Internet would take Lotus Notes off the map, think again. **Lotus Notes Release 4.1 with Domino** (list price: server, \$495 single-processor or \$2,295 multiprocessor; client, \$55 to \$275) offers an improved user interface, better development tools, and easier mobile access than its predecessor.

But it's really the impressive Domino—at press time a free download from Lotus Development Corp.'s Web site for Notes users and soon an integral part of the Notes platform—that merges Notes' unsurpassed groupware functionality with the power of the Internet to create a whole that is truly greater than the sum of its parts.

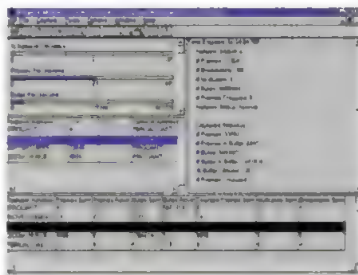
Domino converts any Notes database to HTML on the fly, enabling Web-browser users to have full access to Notes' powerful e-mail, group discussion, workflow, and the like. You can create, edit, and delete Notes database documents using your Web browser. Domino also takes advantage of Notes's powerful database-level security access. Lotus plans to include Domino as part of Notes 4.5, which should be available by the end of December 1996.—*LE*

Lotus Development Corp., Cambridge, MA; 800-346-1305, 617-577-8500; www.lotus.com. (Reviewed: October 8, 1996, page 214.) *Circle 478 on reader service card.*

NETWORK OPERATING SYSTEMS

Microsoft Windows NT Server 4.0

In 1996, **Microsoft Windows NT Server 4.0** comes with a new Windows 95-type interface, an Internet server, Network Monitor, a Web designer, administrative wizards, bandwidth aggregation, and a multiprotocol router. Just as important, the Domain Name Service (DNS) server allows you to set up user names without dealing with numerical addresses, and support for the Point-to-Point Tunneling Protocol (PPTP) lets you make an encrypted connection to a corporate network over the Internet.



The Windows NT Server (\$809 list price for server and five clients) also includes Microsoft FrontPage 1.1. And this version of the OS works fully with NetWare Directory Services (NDS).—*Sarah L. Roberts*

Microsoft Corp., Redmond, WA; 800-426-9400, 206-882-8080; www.microsoft.com. (Reviewed: October 22, 1996, page NE25 in the Network Edition.) *Circle 456 on reader service card.*

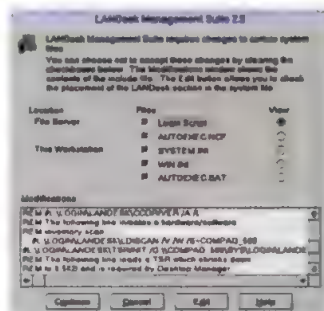
NETWORK MANAGEMENT

LANdesk Management Suite

One of the preeminent network management suites, Intel Corp.'s **LANdesk Management Suite**, Version 2.5 (LDMS), offers software distribution, hardware and software inventory, remote control, software metering, server and network traffic statistics, and integrated alerting and notification. This highlight of 1996 can also manage both Windows NT- and NetWare-based file servers and all your client PCs, whether they run DOS, Windows 3.x, Windows 95, Windows NT, or OS/2.

LDMS (\$750 list price for five users) also provides remote control for NetWare servers. Other hot new features include remote control and management of client PCs across the Internet or an intranet, the Alert Management System, and the Desktop Management Interface (DMI) control panel.—*SLR*

Intel Corp., Santa Clara, CA; 800-548-4725, 408-765-8080; www.intel.com. (Reviewed: August 1996, page NE21 in the Network Edition.) *Circle 467 on reader service card.*



ISDN ADAPTERS

Motorola BitSurfr Pro

Thought you'd never see an easy-to-use ISDN device? The **Motorola BitSurfr Pro** (\$495 list price) gets you going in minutes. This external unit provides two RJ-11 jacks that let you plug in two analog devices such as a modem, phone, or fax machine. If you ordered your ISDN line with two phone numbers, you can program the BitSurfr Pro to route calls to each analog port; faxes go to the fax machine automatically, without interrupting the other channel.

The unit even has an optional uninterruptible power supply. Motorola's BitBrick (\$79 list price) powers the Bit-



Surfr Pro for up to 4 hours—very important if you're using the ISDN line for analog calls and your power's down. Motorola also has a toll-free service to help you order and

configure your ISDN line.—*Todd Spangler*

Motorola Information Systems Group, Huntsville, AL; 800-426-6336, 205-430-8000; www.mot.com. (Reviewed: June 11, 1996, page 170.) *Circle 468 on reader service card.*

U.S. Robotics Sportster ISDN 128K

Though it's an internal card, the **U.S. Robotics Sportster ISDN 128K** (\$299 list price) provides software that makes for easy installation and configuration.

Users may also find that the Sportster is a real speedster: Using its Stac-compatible compression, the

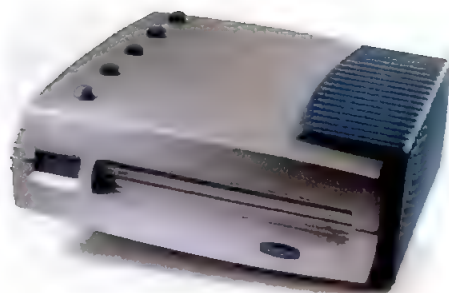


Sportster produced as much as four times the throughput of any other ISDN adapter we looked at.

The Sportster is available as either an ISA or an EISA card, and the unit includes a fully functional analog port. You'll need a separate product, however, in order to generate a telephone ring. The included Sportster Manager utility displays your ISDN setup graphically and provides you with access to the status, diagnostic, and configuration functions.—*TS*

U.S. Robotics, Skokie, IL; 800-877-2677, 847-982-5001; www.usr.com. (Reviewed: June 11, 1996, page 181.) *Circle 469 on reader service card.*

Re



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NETWORK HARDWARE

Stackable Hubs

3Com SuperStack II family

If you're going to be in a LAN cable and connection family, it's hard to think of a more reliable and well-known name than 3Com Corp. Its stackable hub, in the **SuperStack II** product line, offers the flexibility to integrate 100-Mbps networking, switching for Ethernet and Token-Ring, remote access, redundant and backed-up power, and a single-interface graphical network management tool.

You can mix-and-match the modules and features you like from off-the-shelf components. And note that, while a fully stocked SuperStack system could cost \$30,000, a SuperStack Ethernet switching configuration averages out to anywhere from \$58 to \$1,000 (list price) per port. —*Frank J. Derfler, Jr.*

3Com Corp., Santa Clara, CA; 800-638-3266, 408-764-5000; www.3com.com. (Reviewed: September 10, 1996, page NE29 in the Network Edition.) *Circle 471 on reader service card.*



Switches

BayStack Model 28115 Fast Ethernet Switch

For the best combination of flexibility and function in any network faced with integrating legacy investments with new equipment, look to Bay Networks' **BayStack 28115 Fast Ethernet Switch** (\$16,495 list price). Its 16 ports offer the highest density of connections that can run at both switched 10-Mbps and switched 100-Mbps speeds on a single device. In Fast Ethernet configurations, you can set ports at half or full duplex. In addition, two additional uplink ports allow up to seven switches to be cascaded together.

Network administrators can run either single switched environments or a segment switch between older and newer Ethernet groups. Management occurs with either traditional SNMP or Bay's multiplatform Optivity software. —*Jeffrey G. Witt*

Bay Networks Inc., Santa Clara, CA; 800-822-9638, 408-988-2400; www.baynetworks.com. (Reviewed: June 25, 1996, page NE1 in the Network Edition.) *Circle 472 on reader service card.*



CD-ROM Servers

DiscPort family

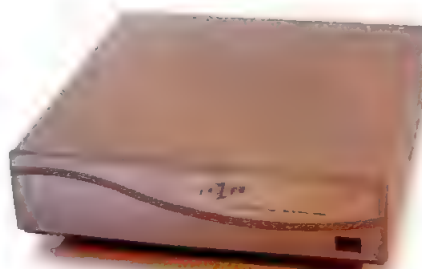
With new Windows NT Server support for DiscPort PRO and DiscPort Tower and its still easy-to-use and powerful management software, Microtest's line of CD-ROM servers once again caught our eye this past year. The **DiscPort PRO** (\$1,595 list price) is a mini-server that lets you attach up to 14 drives to Ethernet via two SCSI ports. The DiscPort Tower (list price: \$5,695

for 7 drives, \$10,495 for 14 drives) is a PC-size plug-and-play networking solution for Ethernet networks.

The latest addition to the product family is the DiscPort XL (\$795 list price), a CD-ROM miniserver that supports up to seven 8X CD-ROM drives on a 10-Mbps network. And by the

time you read this, the DiscView PRO software will include the ability to manage discs over Microsoft Windows NT. —*Michelle Schoenung*

Microtest Inc., Phoenix; 800-526-9675, 602-952-6400; www.microtest.com. (Reviewed: September 24, 1996, page NE8 in the Network Edition.) *Circle 475 on reader service card.*



LAN-to-Internet Connectivity

Instant Internet 3.2

Performance Technology provided the past year's best turnkey solution for linking your IPX-based network to the Internet, without having to install TCP/IP on every client's desktop: **Instant Internet 3.2** (\$2,895 list price for ISDN and 10Base-T model with 20 users). Easy to use and adaptable to various bandwidth needs, Instant Internet provides Internet connection options including a modem, ISDN adapter, or an Ethernet adapter for WAN links.

Instant Internet includes connection scripts for several hundred Internet service providers. In addition, network managers can import users from the NetWare Bindery or Novell Directory Services (NDS). Security options include limiting a user's access based on date, time, and TCP/IP port number, as well as blocking access to newsgroups and Web sites. —*TS*

Performance Technology, a Bay Networks Company, San Antonio; 800-784-4638, 210-979-2000; www.instant.net. (Reviewed: November 19, 1996, page 201.) *Circle 486 on reader service card.*

Remote Access Servers

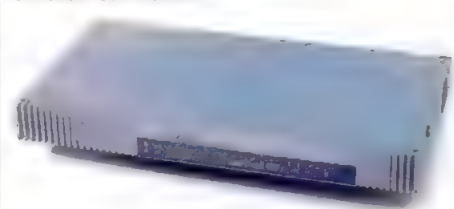
LanRover/EPlus 4.0

Like its predecessor, the **LanRover/EPlus 4.0** is effortless to install and configure. And, once again, this product from Shiva Corp. comes out on top in the remote-access market.

The LanRover/EPlus 4.0 provides dial-in, dial-out, and LAN-to-LAN connectivity using IPX, NetBEUI, and TCP/IP. Version 4.0 (list price: \$8,999 with eight internal V.34 modems; \$7,119 with four ISDN adapters) also adds integrated ISDN support as well as a virtual connection capability that seamlessly suspends and resumes a physical connection (which saves you money on long-distance phone calls).

This product includes Shiva Net Manager (SNM) software, which offers comprehensive management and statistical information. The SNM utility automatically finds the LanRover on the network and enables the administrator to configure users, ports, protocols, and connection methods. It runs on any Windows, DOS, or Macintosh PC. Look for future versions of the product to support PPTP. —*MS*

Shiva Corp., Bedford, MA; 800-977-4482, 508-788-3061; www.shiva.com. (Reviewed: August 1996, page NE13 in the Network Edition.) *Circle 487 on reader service card.*



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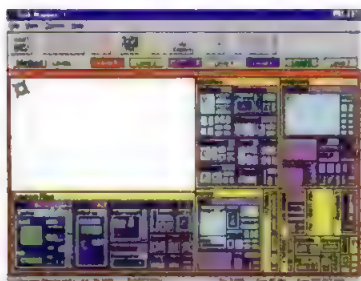
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DiskMapper 1.0

You've got a hard disk that's measured in gigabytes, yet you never seem to have any room left on your disk. To help you find where it all went, Micro Logic jumped into the utility arena and introduced **DiskMapper 1.0** (\$49.95 list price) in 1996.

The program, which runs under both Windows 3.1 and Windows 95, provides you with a graphical view of your hard disk, employing a grid of boxes sized on your screen in proportion to the space consumed by the associated files. In case you want to clean up your disk, DiskMapper allows you to delete, zip and unzip files, and hop out to Explorer. The program is able to map local drives and network drives, and it color-codes files according to various criteria such as directory level, age, and archive status. —*Ben Z. Gottesman*

Micro Logic Inc., Hackensack, NJ; 800-342-5930, 201-342-6518; www.microlog.com. (Reviewed: October 22, 1996, page 52.) **Circle 479 on reader service card.**



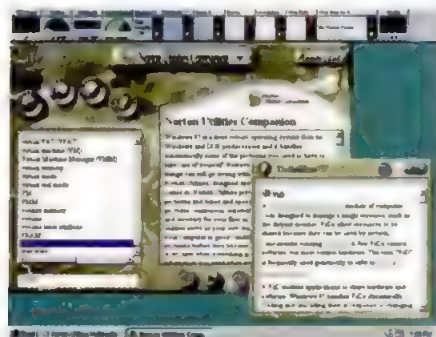
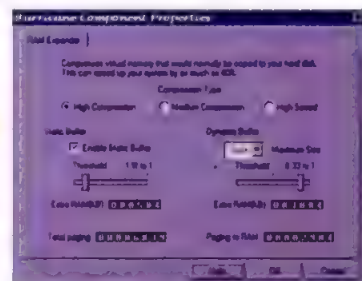
Hurricane 2.0

Even though Microsoft keeps putting new features into Windows, utility authors keep finding new ways to improve on the OS. By replacing much of the guts of Windows with faster code, Helix Software's **Hurricane 2.0** (\$50 street price) speeds up Windows 3.1 and 95 systems.

Under Windows 95, Hurricane 2.0 actually gives you more memory to work with by using the wasted memory on your graphics adapter as a buffer for compressed memory. In fact, the more you tax your system, the more Hurricane improves in performance. It also includes a first-rate system tool.

Even though the cost of RAM fell sharply in 1996, the boost Hurricane provides is well worth the price (particularly for notebook computers, for which additional RAM is still quite costly). —*Larry Seltzer*

Helix Software Inc., Long Island City, NY; 800-451-0551, 718-392-3100; www.helixsoftware.com. (Reviewed: October 8, 1996, page 48.) **Circle 480 on reader service card.**

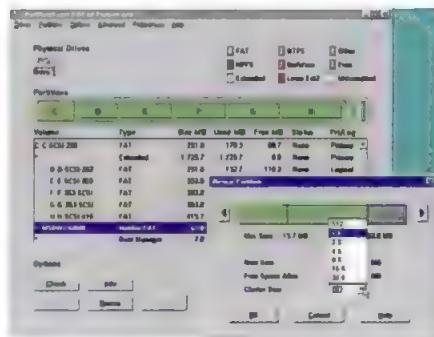


Norton Utilities 2.0 for Windows 95

Long the leader in the desktop utility market, Symantec's **Norton Utilities 2.0 for Windows 95** (\$79 list price) finds itself just about the only utility set left that still offers all the classic tools, including disk diagnostics, defragmenting, and data recovery. But don't think that Symantec is just sitting back and taking it easy. Competition could be right around the corner, so Symantec has been working hard to improve its eleventh version of this product.

The System Doctor constantly monitors your system and automatically invokes the proper tool to fix any potential problems. The various Companions on the program's CD-ROM provide users at all levels of expertise with valuable reference materials. —*BZG*

Symantec Corp., Cupertino, CA; 800-441-7234, 541-334-6054; www.symantec.com. (Norton Utilities for Windows 95 reviewed: May 14, 1996, page 109.) **Circle 481 on reader service card.**



PartitionMagic 2.01

Because hard disks can grow full so quickly, many users aren't prepared to manage them. Hard disks are divided into allocation units called *clusters*; the larger the disk partition, the larger the cluster and the more wasted space on your hard disk. (Each file on the disk uses up a minimum of one cluster.)

With FDISK, the partitioning utility that ships with DOS and Windows 95, modifying a disk's partitions destroys any information stored in them. But with PowerQuest's **PartitionMagic 2.01** (\$69.95 list price), users can resize partitions (make them bigger or smaller) *without* losing data. This version includes the ability to create, delete, and hide partitions, and even to move Windows NT NTFS partitions. By the time you read this, Version 3.0 (\$69.95 list price) will be available; it will support Windows 3.x, 95, and NT, as well as DOS and OS/2 and its HPFS partitions. —*BZG*

PowerQuest Corp., Orem, UT; 800-379-2566, 801-226-8977; www.powerquest.com. (Reviewed: March 26, 1996, page 56.) **Circle 482 on reader service card.**



System Commander

Here's a dilemma: You want to run Windows NT but a few of your programs still don't seem to work properly, so you also want Windows 95 installed. You need a copy of Windows 3.1 and DOS around to help you support other users. And you'd like to leave room to try OS/2 and play with all the Unix Web products out there, too. How do you manage all the different OSs without five PCs? Your answer is **System Commander** (\$99.95 list price).

A multiboot manager that lets you install multiple OSs on a computer (or multiple configurations of the same OS) and easily switch between them, this third release of System Commander from V Communications replaces your master boot record with one of its own. It manages virtually any flavor of DOS, Windows, OS/2, Unix, and NetWare that you can put on a PC. Improved security and the ability to edit system files *before* you load an OS also add to its appeal. —*BZG*

V Communications Inc., San Jose, CA; 415-648-8266, 408-296-4441; www.v.com. (Reviewed: April, 12, 1994, page 50.) **Circle 483 on reader service card.**

NEC Technologies Inc.

PowerMate Pro 2200



NEC Technologies' DMI-enabled PowerMate Pro 2200 (\$3,471 street), one of our Editors' Choice winners, has the features, performance, and comprehensive support programs to make it a great choice for corporate use. The unit is a mainstream corporate system targeted for use in financial, engineering, and software development departments. NEC includes numerous hardware and software features, such as network and system management tools, to reduce the cost of ownership and maximize system performance and security. NEC recently merged with Packard Bell to form Packard Bell NEC. NEC will continue to design and oversee the manufacturing of all of its PowerMate commercial desktop systems.

The PowerMate Pro system's tool-free mini-tower case holds an Intel motherboard with the Natoma chip set. To this NEC adds an IBM 2GB 5,400-rpm EIDE hard disk, a Matrox Millennium graphics card with 4MB of WRAM, and an NEC 8X MultiSpin 8V CD-ROM drive. The NEC MultiSync M700 monitor with integrated speakers is DCC-1 and DCC-2 compliant.

On most of our tests, the unit kept pace with the competition well, posting a score on our Winstone 32 tests that was at the high end of the average range. The unit also had average scores on the AutoCAD and C++ tests.

The PowerMate Pro supports DMI, and a MIF browser is available (although one was not sent for this roundup). Also included were McAfee's VirusScan for NT, Intel's LanDesk and HealthMeter, CyberMedia's First Aid 95, and MagicEye security technology. MagicEye is a combination of hardware and software that detects and reports when the system is opened; it also monitors system temperature, voltages, and fan speeds. The unit also features an IrDA-compliant, 115.2-Kbps infrared interface, which you can put to work with the included copy of Puma's TranXit.

NEC covers this line with a three-year warranty; on-site service is free for the first year. On-site coverage for two more years costs \$99. Augmenting its round-the-clock technical support, NEC has dedicated toll-free support lines for corporate customers, who are routed immediately to PowerMate technical-support specialists. Other service and support programs for corporate customers are available.—BB

PowerMate Pro 2200. Street price: \$3,471. NEC Technologies Inc., Boxborough, MA; 800-632-4636, 508-264-8000; fax, 800-366-0476; www.nec.com. Circle 470 on reader service card.



IN MOVIES, IT'S THE OSCAR.
IN TV, IT'S THE EMMY.
IN MUSIC, IT'S THE GRAMMY.
IN OUR LINE OF BUSINESS,
IT'S THIS PIECE OF PAPER.



In a recent issue of *PC Magazine*, the NEC PowerMate® system won the Editors' Choice Award for Pentium® Pro processor-based PCs. In categories that included features, performance, support and price, we outclassed IBM, Compaq and Dell. For more information, call 1-800-NEC-INFO. Or visit our web site at <http://www.nec.com>. Better yet, simply read what the editors of *PC Magazine* wrote. SEE, HEAR AND FEEL THE DIFFERENCE.™

NEC



THE BEST OF

Abort, Retry, Fail?

Hey, Macarena! It's time for our annual survey of the wackiest computing moments of the year. And as we look forward to 1997, remember the advice of this classy MindWire NT ad (left): "Don't leave any gaps in your Internet strategy."

By Don Willmott

THE 1996 ARF AWARDS

The Marge Schott Award for Best Casting of Aspersions

On July 5, the Spanish-language version of Microsoft Word 6.0 was revealed to have a thesaurus that included the words *savage* and *man-eater* as synonyms for *Indian*.

Most-Often-Recounted Urban Legend

A PC tech-support rep gets a call from a customer who has broken his PC's cup holder. Cup holder? Turns out he's actually talking about the CD-ROM drive. Ha ha. This "true" story happened in Utah. Or was it California? Or Texas? Or Florida? Or Australia?



Worst Way to Promote a Party

A Microsoft invitation to an event called the Thrall Ball, in New Orleans on August 7, included a bloody handkerchief that smelled really, really bad. We don't get it.

Most Image-Conscious Chip Company

The evil corporation in the movie *Eraser* was called Cyrex—or it was until Cyrix found out about it and demanded a change. At great expense, editors went back to the special-effects computers and changed all the appearances of Cyrex to Cyraz. Not that we

See next page, right hand column

Summer Movie Blockbuster Disasters

In *Mission: Impossible*, Tom Cruise popped open his PowerBook and logged onto the Internet in under 2 seconds. Yeah, right. Tell us, Tom, who's your service provider, and where can we sign up?



In *Independence Day*, Jeff Goldblum traveled with a notebook that could communicate wirelessly with the internal systems of the alien mothership. Talk about cross-platform compatibility! What a load of intergalactic hooley!



That's no way to treat a computer! In *Twister*, a savage hailstorm blew in and golf-ball-size ice chunks fell from the sky. Helen Hunt ran to her truck, holding her notebook over her head to protect herself from the hail.

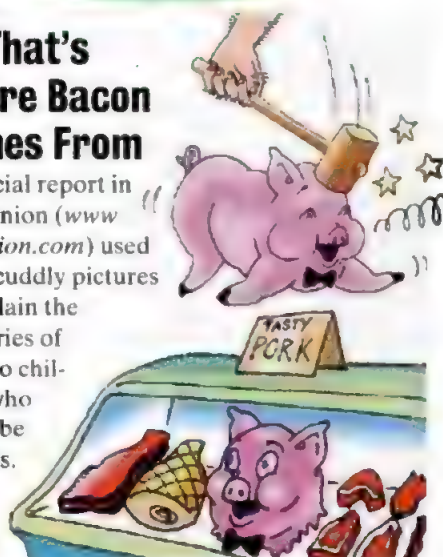


Winners this issue: Chris Andrews, Stephanie Chernoff, David Martin, and Nathan Walpow.

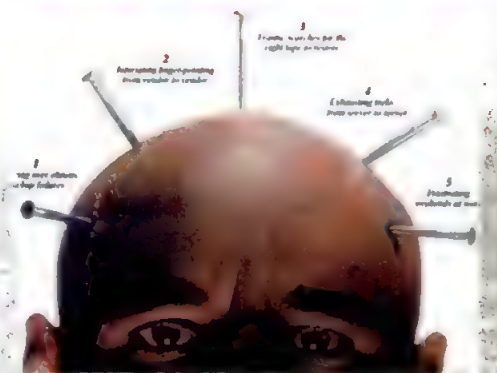


So That's Where Bacon Comes From

A special report in *The Onion* (www.theonion.com) used these cuddly pictures to explain the mysteries of meat to children who might be curious.



Trends in Advertising: Pain,

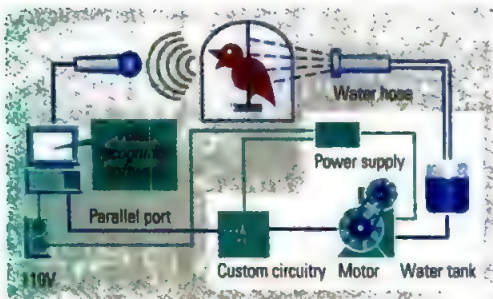


Excedrin Headache #38



Biggest Rodent Found In a Printer

A terribly cute possum took up residence in reader David Martin's HP DeskJet. Yet another interesting benchmark test idea.



Torture Your Parrot with Voice Recognition Software

Bloch's \$200 Stop Squawk will train your bird to shut up once and for all. Just put Polly next to a PC equipped with voice recognition software and she'll get hosed every time she makes a peep. How sweet.

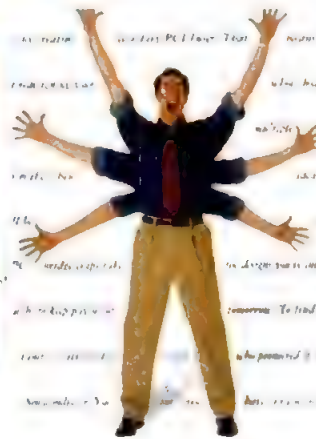
Horror, and Abuse



You said a mouthful.



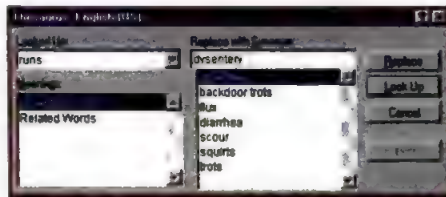
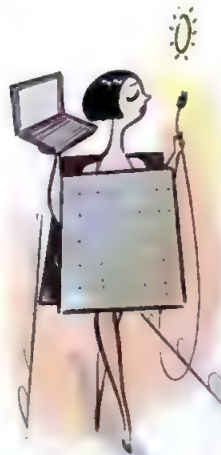
Dream about this tonight.



Buying shirts is murder.

Fashion Don'ts

Sometimes the avant-garde is a little too avant. In its issue of July 29, 1996, *The New Yorker* reported the latest news from the Paris fashion shows: "Oliver Lapidus comes onstage to point out that his collection is a mixture of past, present, and future, and includes the first solar-panelled jacket ever made. He shows it off. You can control the solar panels, turning the heat up and down, and it also has a built-in plug that could 'brancher' you right into the Internet, the first haute-couture garment equipped to go on line. The poor model has to take the plug out of the pocket and show it to the audience. Then you hear the theme from 'Star Trek.' Nobody knows which way to look."



With a Thesaurus like This, Who Needs Enemies?

Microsoft Word has some interesting suggestions for replacing the word *runs*.

noticed. We were too busy watching Vanessa Williams kick-box like crazy.

Funniest Randomly Assigned America Online Password SMUTTY-VICARS

Truest Statement Made by a Zillionaire

In July, Bill Gates addressed a group of Canadian schoolchildren. Later, a reporter suggested that parents might have sent their kids to pick up pointers on being financially successful, to which Gates replied, "I don't think any magic fairy dust is going to wear off."

Worst Press-Release Headline

A release for The International Thomson Publishing Olympic Factbook Online asked, "Why did early Olympic fencers dip their uniforms in vinegar?"

Software Most Likely to Rankle God

For \$50, you can buy Confession by Computer, which dishes up the appropriate penance when you tell it your sins.

Daffiest Definition

Net 'n' Yahoo: the result of a Netscape/Yahoo! merger.

Most Annoying Appearance of An AOL Sign-Up Disk

Lunch on a nonstop American Airlines flight from New York to Seattle in August included a 3.5-inch floppy disk. Like most airline food, it tasted terrible.



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MEDIA NOTEBOOKS TO OFFER EVEN WHAT COULD BE MORE NATURAL?



**Echos
Pro 150S**

Echos Pro Notebook Standard Features:

Pentium® processor, PCI Bus, 256K L2 cache, 16MB RAM expandable to 128MB, 28.8K internal modem, 2 PC Card slots with PC Card Bus and Zoomed Video, Win 95 keyboard, Li-Ion battery, Multi-function bay: 8X CD-ROM and modular FDD (std.), second HDD (opt.)



Echos Pro 150S

150MHz Pentium® processor, 12.1" SVGA TFT display, 2GB Removable HDD

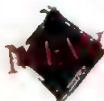
\$4,999



Echos Pro 133S

133MHz Pentium® processor, 12.1" SVGA TFT display, 2GB Removable HDD

\$3,999



Echos Pro 133D

133MHz Pentium® processor, 12.1" SVGA DSTN display, 1.3GB Removable HDD

\$3,499



The optional Echos™ Pro Docking System offers full port replication, Multi-function bay, drive bay, 2 PCI Card slots, plus much more. It's the perfect solution for desktop replacement.



**Echos
P133S**

Echos Notebook Standard Features:

Pentium® processor, PCI Bus, 256K L2 cache, 1.3GB removable HDD, Multi-function bay: 6X CD-ROM and modular FDD (std.), second battery (opt.)

Echos P133S

133MHz Pentium® processor, 16MB RAM expandable to 40MB, 11.8" SVGA TFT display

\$3,399

Echos P120E

120MHz Pentium® processor, 8MB RAM expandable to 40MB, 11.3" SVGA TFT display

\$2,799

Echos P100E

100MHz Pentium® processor, 8MB RAM expandable to 40MB, 10.4" SVGA TFT display

\$2,399

Echos P100C

100MHz Pentium® processor, 8MB RAM expandable to 40MB, 11.3" SVGA DSTN display

\$2,099

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EIZO NANAO WINS AGAIN!

Back To Back Nod For Monitor Maker

By Rex O. Looshun
MONITOR STAFF WRITER

LOS ANGELES — It's an announcement that is becoming all too familiar. EIZO Nanao Technologies has once again taken home the coveted Editor's Choice Award from PC Magazine.

This sixth award in the past six years goes to the company's FlexScan® TX-C7S 17-inch class color monitor. It's an honor that carries particular significance as it cites superiority in the judging category having the toughest standards.

"The TX-C7S monitor's image was especially sharp and clear, with no detachable faults," said a PC Magazine judge.

Not too surprising for EIZO, though. The company's monitors previously earned Editor's Choice



**October 8, 1996
FlexScan TX-C7S**

accolades in 1990, 1992, 1993— for its FlexScan 9400, F550iW and FlexScan F340iW monitors— and last year for its highly regarded FlexScan T2-17TS model.

TX-C7S Lauded as 'Best of the Best'

By E.Z. Viewlin
MONITOR STAFF WRITER

LOS ANGELES—Words such as "unbeatable," and "top flight," have been flying around town ever since EIZO Nanao's FlexScan TX-C7S 17-inch class color monitor walked off with the 1996 PC Magazine Editor's Choice Award.

With this key award under its belt, the FlexScan TX-C7S figures to be the monitor of choice for graphics and business professionals who demand crisp, true-to-life colors and stable screen images



This year's big winner: The FlexScan TX-C7S 17-inch class color monitor.

for desktop publishing, 24-bit imagery, high-end graphics and multimedia applications.

Editor's Choice: The Award That Shapes Industry Thinking



It's deja vu all over again: EIZO Nanao has now won six Editor's Choice Awards in six years.

By Maria Turr
MONITOR STAFF WRITER

LOS ANGELES—Winning a PC Magazine Editor's Choice Award tells the world of hungry hardware buyers that you've arrived in a big way.

"It's the one award we all dream about, the one we covet more than any other," said N.V.S. Guy of Silicon Valley's LuzerCom.

EIZO Nanao monitors have earned worldwide recognition for dependability, cost-effective performance and pleasing, ergonomic design. In fact, I'm going to stop writing this story right now so I can call EIZO Nanao Technologies at 1-800-800-5202. Then again, I could get an informational fax on demand by calling 1-800-416-FLEX. Either way, like the TX-C7S, I'm a winner.



EIZO is Nanao's New Universal Brand Name
EIZO Nanao Technologies Inc., 5710 Warland Dr., Cypress, CA
90630 Web Site: <http://www.eizo.co.jp/welcome>

Heave-Ho, Silver!

The 11 digital cameras we review here cost less than \$1,200 each. Just don't expect them to compete with film.

Traditional Silver Halide Film

This side was taken with a professional 35-mm Nikon camera.

Digital Camera

This side is from the \$950 Canon Powershot 600, an Editors' Choice in this roundup.

By Daniel Grotta & Sally Wiener Grotta

Digital photography is fast becoming a mainstream technology. Camera prices are coming down and image quality is going up, making such point-and-shoot devices an attractive option for increasing numbers of business users and hobbyists.

Nearly 2 million entry-level digital cameras will be sold in 1997, in a market that will see sales of 25 million PCs, according to Dataquest, a San Jose-based market-research firm. The existing users of the technology—real estate

agents who want to include photos on computer-based listing sheets and insurance claims adjusters who need electronic documentation for claims—are being joined by a wider business audience that needs to add images to presentations, newsletters, and Web pages.

Moreover, as prices continue to drop and features increase, filmless photography is beginning to attract a new class of users: ordinary consumers. As the vision of a PC in every suburban plot (connected to a photo-capable ink jet printer) steadily becomes a reality, more families will



Read more about it
and participate in
our discussion
December 16-20

www.pcmag.com

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drop their traditional point-and-shoot cameras in favor of easy-to-use digitals. Granted, digital images printed on a standard (or even a high-end) color printer won't have nearly the quality of prints made from traditional silver halide film. But the immediacy of a digital capture is a plus for many applications, and if you plan to publish an image on a Web site or in an electronic document, the lower image quality may be barely perceptible on-screen.

REVIEW CRITERIA

To be included in this roundup of entry-level digital cameras, we required that a device be a portable camera able to capture photograph-like images in 24-bit color electronically. We also required that units cost no more than \$1,500 on the street.

We tested a total of 11 products, with prices ranging from \$300 to \$1,200. Three of them—the Apple QuickTake 150, Dycam 10-C (our Editors' Choice winner in this category last year), and Kodak DC40—were holdovers from last year's roundup. The Casio QV-10A Plus is a slightly refreshed version of the Casio unit we reviewed a year ago ("The Death of Film?" February 6, 1996), while the Agfa ePhoto 307, Canon PowerShot 600, Epson PhotoPC, Fujix DS-220, Kodak DC20 and DC50, and Olympus D-200L are brand-new units. Entry-level cameras from Nikon, Ricoh, and Sony were not available in time for this roundup, and many more camera and scanner manufacturers—including Hewlett-Packard, Konica, Mustek, Pentax, Plustek, and Sam-

sung—are readying entry-level digitals for release sometime this year.

Our test script had reviewers use the cameras for a few days and snap a range of shots to evaluate features, ease of use, ergonomics, and image quality. For our more objective evaluation of image quality, we had *PC Magazine's* resident photographer, Thom O'Connor, shoot indoor and outdoor scenes with each of the reviewed cameras (see the sidebar "Guide to Digital Camera Output" for details and sample images).

Two other types of digital cameras, offering more features and better image quality, are suitable as replacements for film cameras for professional photographers. We look at the emerging class of midrange cameras (those costing from \$1,500 to \$10,000) in the sidebar "Midrange Cameras: New Options for the Pros." And even higher-end devices (which can cost up to \$28,000) are available for professional photographers requiring large, reproduction-quality images.

A HYBRID TECHNOLOGY

A digital camera is a cross between a conventional film-based camera and a scanner. The front end uses a lens, aperture, and shutter to focus an image, in much the

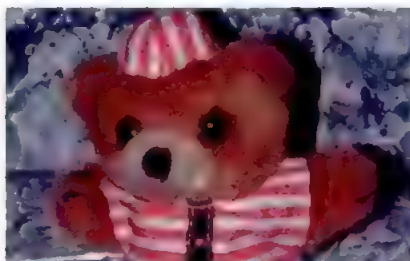
HIGHLIGHTS

Making the Move to Digital Cameras

One factor that has kept digital photography from really taking off has been high cost—until now. At under \$300 for a low-end entry-level camera, and with a slew of manufacturers developing models this year, digital cameras are on the verge of becoming a mainstream darling.

IMAGE QUALITY No one claims digital images rival 35-mm photographs. The silver halide crystals used to make film can capture an almost infinite range of tones and colors, while the CCDs that digitals use tend to lose detail (what's called "clipping") in low or bright light and sometimes have difficulty correcting color. Most digital cameras, however, produce pictures at a respectable 640-by-480 resolution or better, which is adequate for a wide range of applications: everything from photo IDs to Web images. And digital cameras are a real boon for insurance claims adjusters, real estate agents, and law enforcement officers who need to capture images for PC use quickly and easily.

COMPRESSION IS KEY More important than resolution or CCD quality is the degree of data compression the camera uses to save images. The lower the compression ratio, the higher the image



quality. But lower compression also means images take up more valuable memory space. The shots to the left (from the Kodak DC50) show the same image with higher compression (lower quality) and lower compression (higher quality). Given the generally low quality of digital images as compared with film, we recommend shooting with the lowest possible compression ratio.

WHAT WORKS FOR SILICON While film enjoys the benefits of a 155-year evolution, charge-coupled devices (CCDs) suffer from the limitations inherent in any nascent technology. Acceptable color balance, in particular, is difficult to achieve. Many traditional photographers find shooting good digital pictures difficult, especially when using available light or studio lighting. The trouble is that they assume what's right for silver halide film also works in the digital realm. CCDs, however, work best in flat lighting, with at least twice the amount of light normally used; also, digitals respond especially well to strobe and HMI lights.

same way as in traditional film photography. But the image is focused not onto light-sensitive silver halide film but onto a semiconductor chip called a *CCD* (charge-coupled device). The data is then passed to an analog-to-digital converter (ADC) chip, compressed, and then recorded on either built-in memory chips or a removable PC Card.

Most entry-level digital cameras look, feel, and function much like conventional 35-mm point-and-shoot cameras. To operate one, you simply turn the device on, frame the subject in the viewfinder, and press the shutter. There is no need to focus, and there are no f-stops or shutter speeds to set. After the images are recorded, you may transfer them to a PC or notebook computer via the serial or parallel port, or by removing the camera's PC Card and popping it into a PC Card drive.

Several important differences exist, however, between these devices and traditional cameras. The first is a delay of up to 1.5 seconds between when you press the shutter button and when the camera actually takes the picture. That's the time necessary for the light sensor to read the scene and either adjust the diaphragm opening (f-stop) or change the shutter speed, to check the auto-focus (for cameras with this feature), and to trigger the camera's flash (except for the Casio QV-10A Plus and Kodak DC20, which don't have a built-in strobe). In this roundup, the Canon PowerShot 600, Dycam 10-C, and Kodak DC50 had the most noticeable lag times.

This delay probably won't bother real estate professionals shooting buildings, but it can be frustrating when you're trying to capture squirming children or hyperactive animals. And after you snap the picture, there is another 4- to 9-second delay when the camera is "busy." That's how long it takes to convert the image to digital form, compress and save it, and recycle the flash.

Another difference is the number of exposures the camera can capture before its memory is full. Most of our entry-level digital cameras have from 1MB to 4MB of

Editors' Choice

- Business professionals: Canon PowerShot 600
- Casual users: Kodak DC40



If you will be using a digital camera often in your work—for real estate listings, insurance documentation, or desktop publishing images—and image quality is paramount, the best entry-level digital camera is the Canon PowerShot 600 (\$950 street). Image quality was consistently the best in our test group, with excellent detail and sharpness, thanks to its superior resolution (832-by-608) and its Custom mode, which lets you save images uncompressed. The 14-ounce PowerShot saves images to standard PC Card memory cards, which makes it a good candidate for field use.

If you'll be using a digital camera only occasionally, the Canon may be overkill. Among the lower-priced units here, the Kodak DC40 (\$600 street) stands out. It delivers higher-resolution images (756 by 504 pixels) than most others in its price range,

internal nonvolatile flash RAM, which translates into as few as 8 or as many as 96 images, depending on the camera and on picture quality. The images you want to keep must be uploaded to a PC before you can purge the camera's memory and resume shooting. The Dycam 10-C, Fujix DS-220, and Kodak DC50 cameras accommodate convenient (but expensive) Type I or Type II PC cards; the Canon PowerShot 600 can save to higher-capacity Type III hard disk cards, which can hold up to 900 images.

The 11 cameras reviewed in this story show that there's a combination of image quality, feature set, ease of use, and affordability to match any need.

and on our tests its images showed good highlights and midtones, with only minor pixelization. The 16-ounce DC40 is as simple to use as any traditional point-and-shoot 35-mm automatic camera, and its generous

4MB of internal memory can hold 48 low-compression (meaning highest-quality) images.

Three other cameras here are worthy of honorable mentions. Like the Kodak DC40, the Agfa ePhoto 307 (\$600 street) is simple to use; it produced better-than-average images on our tests. The Olympus D-200L (\$600 street) deserves an honorable mention as one of the

best-designed cameras we tried, with thoughtful features such as a built-in LCD screen for previewing photos. The bargain-priced Epson PhotoPC (\$400 street) delivers image quality comparable to that provided by more expensive units, though it can hold only 32 shots at a time.

DIGITAL VS. TRADITIONAL

The most important difference between silver- and silicon-based cameras is image quality. Silver crystals are far smaller than the *pixels* (picture elements) captured by a CCD. And instead of recording only two states (light or dark), as a digital camera does, they can capture a range of continuous tones and colors.

What's more, a typical frame of 35-mm Kodachrome film can resolve up to 2,500 lines per inch (that is, it's possible to photograph 2,500 very fine separate lines without having them run together into a single block). The Canon PowerShot 600, the highest-resolution digital camera we tested, by contrast, has a resolution of 300 lines per inch on its 4.8- by 3.6-mm CCD.

Film can also capture far more detail in



Our Contributors: DANIEL GROTTA and SALLY WIENER GROTTA are contributing editors of *PC Magazine* and the authors of *Digital Imaging for Visual Artists* (McGraw-Hill). LORI GRUNIN and JAMES KARNEY are frequent contributors to *PC Magazine*. JAMIE M. BSALES was the associate editor in charge of this story, and JEFF MACE was the project leader.

HARDWARE

Digital Cameras

the highlights and shadows of a scene, whereas CCDs tend to *clip*, or lose detail, in low or bright light. Even when it's possible to adjust for clipping at either the light or dark end of the brightness range, the CCD's *dynamic range*—the ability to capture a full range of shadows and highlights—is much more limited than that of film. Also, most CCDs have a built-in bias toward the infrared end of the spectrum, meaning they have more difficulty correcting color under some lighting conditions. Film, too, has a tendency toward one color or another, but the manufacturer can compensate more precisely for it by adjusting the red, green, and blue (RGB) filters sandwiched between layers of film.

DIGITAL CAMERA DIFFERENCES

Most of the cameras we tested are capable of producing images at VGA resolution, or 640-by-480 pixels. Four are capable of slightly higher resolution: The Kodak DC40 and DC50 produce 756-by-504-pixel resolution, and the Canon PowerShot reaches 832 by 608 pixels. At the low end, the Casio QV-10A Plus and Kodak DC20 have resolutions of 480 by 240 and 493 by 373 pixels, respectively.

That's generally good enough to display on a 15-inch monitor, to place a quarter-page picture in a DTP document, or to output snapshot-size (3-by-4-inch to 4-by-6-inch) color prints. When enlarged or electronically displayed beyond those modest dimensions, however, the images become *pixelated* (broken up into blocky squares of color) and indistinct. To put that into perspective, a photograph shot with a conventional 35-mm camera and using fine-grain film can easily be enlarged to 11 by 14 inches or 16 by 20 inches without its grain pattern (the silver halide equivalent of pixelization) becoming obvious or distracting.

Resolution is not the only factor that affects a digital camera's image quality. There are differences in the design and manufacture of CCDs. For instance, a camera like the Epson PhotoPC has the same 640-by-480 resolution as the Apple QuickTake 150. But the Epson's images might appear slightly sharper to some people because it produces square rather than round pixels. Some CCDs have more distance between sampling points (resistors). This has the net effect of increasing

the *gain* (the ISO sensitivity equivalent, or how much light needs to fall on the CCD to produce an image) without increasing the *noise* (an unwanted electrical signal that produces stray artifacts or spots). The problem is that as you increase the size of the CCD, you increase the number of sampling points, and the cost of the chip rises. To keep prices down, entry-level cameras use small CCDs, generally from one-third to one-half of an inch diagonally.

What matters more than resolution or even CCD quality is the degree of data compression the camera's firmware uses in saving images. Only two cameras, the Agfa ePhoto 307 and the Casio QV-10A Plus, can actually switch from a standard (low) to an economy (lower) resolution; the other cameras don't change resolution but raise or lower the compression rate. Naturally, there is bound to be a difference of quality between a camera like the Casio QV-10A Plus, which saves each raw image as a 25K proprietary-format file and interpolates it to a size of 900K (a ratio of 36 to 1), and one like the Canon PowerShot 600, which saves raw images as JPEG files of up to 368K in size and decompresses the files to a size of 1.4MB (a ratio of 4.5 to 1).

Each manufacturer uses a euphemistic description to identify the compression level being used, such as "fine," "superfine," "standard," "economy," and so on. What the manufacturers are really describing is high, medium, or low compression. And because these are *lossy* compression schemes (meaning that data is lost in the reduction), the higher the compression rate, the lower the image quality. Given the relatively low image quality even in the highest-resolution, lowest-compression modes, we strongly recommend shooting only at the best picture setting.

Another important factor in image quality is firmware and software. Besides having the highest resolution of all the cameras we tested, the Editors' Choice Canon PowerShot 600 performed consistently better because it automatically applies *white balance* (color correction) to images as it acquires them. Several other entry-level digitals also have automatic white balance, but they did not react as well to lighting conditions other than bright sunlight. With the Dycam 10-C you

can perform the same automatic color correction (as well as sharpen contrast and increase color saturation) using software, by tweaking various preferences in its driver.

IMPROVEMENTS STILL NEEDED

While digital cameras are experiencing the same cheaper/better/faster paradigm as the rest of the computer industry, the technology has much room left for improvement. CCDs are still very expensive to manufacture; their densities need to be boosted dramatically, and various inherent technical limitations need to be overcome.

One persistent problem is color balance. Most CCDs are balanced for direct sunlight and electronic flash and do not do well at all with other light sources. In a still life lit with standard quartz halogen lights (as one might do for a product shot), for instance, all our images exhibited a pronounced blue cast (although the Canon PowerShot 600's automatic white balance minimized this effect). It thus became clear that the CCDs have very little color temperature latitude. Similarly, all the cameras exhibited a limited dynamic range, *color aliasing* (the breakup and bleed of color along edges), and *artifacts* and *noise* (unwanted stray pixels that look like specks of dust) in varying degrees.

MORE BELLS AND WHISTLES

The features and creature comforts today's entry-level cameras offer have improved dramatically from just a year ago. For instance, a microphone is built into the Canon PowerShot 600, into which a user can speak to annotate or identify each frame. The Casio QV-10A Plus, Fujix DS-220, and Olympus D-200L each have a built-in or add-on color LCD screen that you use both as a viewfinder and to preview an image to see if you wish to keep it. These three cameras can output a standard NTSC signal to any television set or camcorder.

It's certainly true that the pictures that entry-level filmless cameras generate are too small and poorly detailed for professional, photo-quality enlargements. But they are perfectly acceptable for Web pages, newsletters, flyers, family pictures, and any other documents that can be desktop-published by a color ink jet or laser printer. We're edging ever closer to the day when business users and hobbyists will move completely from silver to silicon.



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Agfa Division, Bayer Corp.

ePhoto 307

Simplicity is the key word for Agfa's ePhoto 307 (\$600 street). It not only looks and feels like a 35-mm point-and-shoot camera, it almost works like one. It is well suited for Web page production, real estate and hobby use, and similar applications, and it offers fun along with plenty of value and good image quality.



SNAP HAPPY: Agfa's ePhoto 307 will have you shooting above-average images right out of the box.

Most users will be able to snap pictures and upload them onto a PC after only a brief skim of the manual. Setup is painless: Just pop four AA batteries into the bottom of the camera. The ePhoto 307 lets you shoot up to 36 640-by-480 or 72 320-by-240 24-bit images, stored in 2MB of internal flash memory. An LED panel displays the number of frames available, battery status, flash mode, resolution, and whether the 10-second timer is set. The camera uses a 43-mm lens that produces a slightly wide-angle view similar to that of most 35-mm point-and-shoot cameras. The ePhoto, however, lacks some of the options of the higher-priced products we tested, such as macro attachment, an LCD preview window, and removable memory.

Agfa's custom PhotoWise software installs in a snap and lets you control all camera functions while connected to the computer. The software automatically detects a camera attached to the serial port, then constantly monitors its battery condition and memory status. Images are transferred to the PC, then duplicated as thumbnails compiled in an album. This allows you to view the thumbnails and then delete one or more of the originals. PhotoWise is as intuitive to use as the camera and offers basic cropping and editing tools. Agfa also in-

cludes Adobe PhotoDeluxe for more demanding image-editing tasks.

The ePhoto 307 gave pleasing results (for 640-by-480 resolution) during our tests. Skin tones in both interior and exterior environments appeared natural, and in our office setting the flash produced good color within its shooting range. Under overcast conditions, however, the ePhoto 307 came up short. Colors were washed out unless the subject was close enough for fill flash. (This problem is typical among the current crop of digital cameras.)

Overall, the ePhoto 307 gave us average to slightly above-average images compared with the others we tested, and it was a joy to operate. Its lack of advanced features will limit its acceptance for more demanding applications, but its low cost and ease of use should make it a favorite with entry-level users.—James Karney

ePhoto 307. Street price: \$600. Agfa Division, Bayer Corp., Ridgefield Park, NJ; 800-227-2780, 201-440-0111; www.agfahome.com. Circle 441 on reader service card.

Apple Computer Inc.

QuickTake 150

Although only a year and a half old, Apple's QuickTake 150 (\$629 list, \$600 street) is the granddaddy of entry-level digital cameras. Its predecessor, the QuickTake 100, became a best-seller among users at small and mid-size businesses and in the education market.

Although it has been somewhat eclipsed by less expensive devices offering higher resolutions, larger storage capacities, and more features, we found there's still plenty of life in the QuickTake 150.

The QuickTake 150 is a simple point-and-shoot device with a fixed-focus lens and 1MB of built-in memory. That's enough RAM to capture 16 best-quality or 32 standard-quality 640-by-480 images. Weighing about a pound, it's comparable in size and shape to a small paperback. Its



MIXED BAG: Apple's QuickTake 150 lets you snap a combination of standard and best-quality images.

three AA batteries might need replacement more often than you expect. Heavy shooters might consider adding Apple's eight-cell battery booster pack (\$49).

To snap a picture, simply line up the shot in the viewfinder and push the shutter. The LCD control panel allows you to activate the self-timer, delete all images, select the flash type, and switch compression levels. Unlike some cameras, the QuickTake lets you mix best- and standard-quality images. There's also an option for changing the camera's name when it's connected to a PC, which will be useful to companies that share one camera among several employees.

The included software, QuickTake 1.5, is very light on preupload tools; you can do little more than rotate the picture. Its image-editing features are limited as well, only letting you adjust brightness and compensate for fluorescent lighting, rotate, resize, and select color depth. In case you require more robust software, Apple obligingly includes a mail-order form for a \$99 upgrade to PictureWorks' PhotoEnhancer.

We hadn't expected the QuickTake 150 to fare well against cameras with higher resolutions and better CCDs, since it is the oldest model in our roundup. To our surprise, the indoor test shot was crisp and well defined. When shot with the camera's flash, images showed good color balance and saturation, producing pleasing skin tones and fine detail. Color outdoors was

only fair, however, and the sensor didn't read the light properly, failing to trigger the automatic flash to illuminate the subjects' faces.

The QuickTake 150 won't satisfy users who want immediate feedback via an LCD screen, swappable memory cards, or a zoom lens. Despite its limitations, however, the camera is noteworthy for a reliable level of picture quality.—DG and SWG

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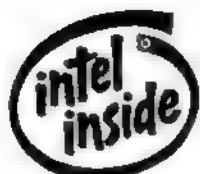
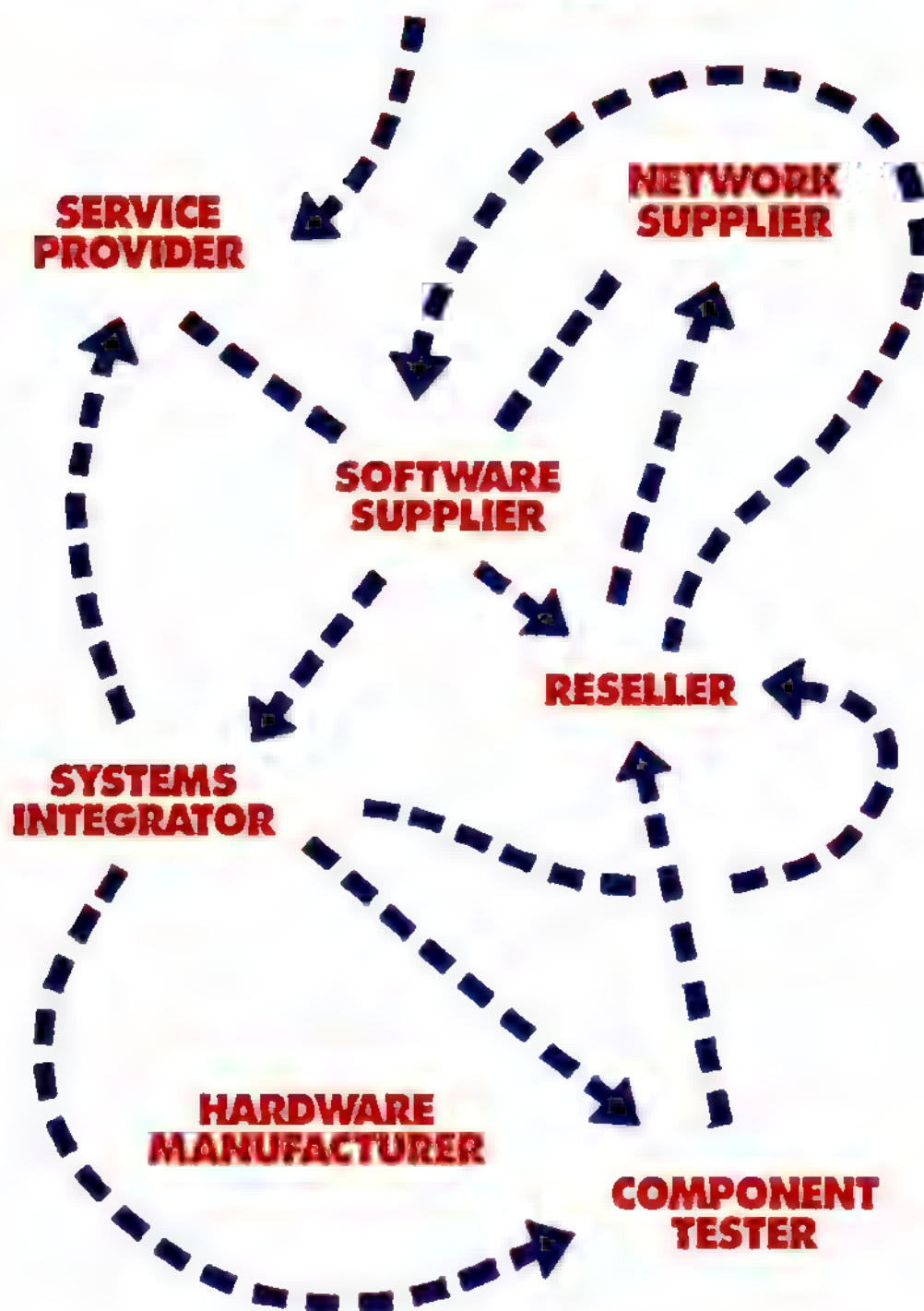
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Midrange Cameras: New Options for the Pros

Entry-level digital cameras are fine for capturing images for Web pages and the like, but they're simply not suitable for more demanding applications like photojournalism, catalog shots, or records of medical operations: The low-end CCDs simply do not capture enough data to produce photographic-quality 5- by 7-inch or 8- by 10-inch glossies. Until now, professional photographers who wanted more data (and hence better pictures) and greater control over

resolution and functionality of devices that have traditionally cost thousands of dollars more.

KODAK DCS 410

The Kodak DCS 410 (\$7,000 street) from Eastman Kodak (800-235-6325, www.kodak.com) is built on a Nikon N90s chassis and can accommodate most Nikon lenses and accessories. It uses the same Kodak 1.5-million-pixel CCD as its \$11,000 big brother, the DCS 420, which yields a resolu-

tion of 1,524-by-1,012. It's the only midrange filmless camera that features a color depth of 36 bits. The N90s body sports a built-in microphone that lets you annotate each frame with shooting info, which is saved as a .WAV file.

There are relatively minor differences between the DCS 410 and the more expensive DCS 420. For instance, unlike the DCS 420, which can fire off a five-frame burst at 2.3 frames a second before it must pause, the fastest that the DCS 410 can shoot is one frame every 2.5 seconds. The DCS 410 is best suited for

professionals and advanced amateurs who are used to shooting with conventional Nikon systems.

AGFA ACTIONCAM, MINOLTA RD-175

Except for the firmware and software, there's no difference between the Agfa ActionCam (800-227-2780, www.agfahome.com) and the Minolta RD-175 (800-964-6658, www.minoltausa.com). Both of the cameras are street-priced

between \$6,000 and \$7,000, are built on Minolta's Maxxim 500si bodies, have built-in flashes, and accept all Minolta lenses and accessories. The Agfa/Minolta is the only digital camera that incorporates three CCDs to record images, a technology that helps eliminate color aliasing while pushing resolution up to 1,528-by-1,146. Images are saved to a PC Card Type III hard disk (a 131MB disk will store 114 images) and decompress to a file size of 5MB. Pros may pass on this camera because of various limitations—limited focusing and metering modes and lenses that are incompatible with professional Canon or Nikon systems, for instance—but ease of use and excellent image quality make it a good choice for serious amateur photographers.

NIKON E2n

The \$9,995 Nikon E2n (800-526-4566, www.nikonusa.com) is probably one of the most complicated and cumbersome-looking—as well as most versatile—cameras ever built. It's a hybrid digital and video device that captures images digitally but lets them be immediately viewed or broadcast by attaching a cable to any TV, computer monitor, or camcorder. The E2n offers an impressive list of professional features, such as six light modes and four compression modes. Constructed around a modified Nikon F4s body, it saves its 1,280-by-1,000, 3.7MB image files to Type II PC Card flash memory cards. Unlike other midrange digital cameras, the E2n attaches to the slower serial port rather than a SCSI interface; if you often upload images to a desktop PC, you may want to consider outfitting your system with a PC Card reader like the SwapBox (\$149) from SCM Microsystems (408-370-4888, www.scmmicro.com). The E2n is strictly a professional camera for users needing NTSC-standard video output as well as digital capture.—DG and SWG



each shot had to spend \$12,000 to \$28,000 to buy a high-end real-time digital camera like the Canon EOS-DCS 3, the Fujix DS-515, or the Kodak DCS 460.

A new midrange class of digital cameras is emerging, however, and today's buyers can select from among several new units that cost between \$3,500 and \$10,000. These prices are hardly cheap, but the units deliver the

A rose is a rose is a... wait a second.



Kodak DC-40 Digital Camera



Casio QV30 Digital Camera



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Street price may vary. Rose photos were taken with the Casio QV30, Kodak DC-40 and EPSON PhotoPC 500 as configured for retail sale. No special effects or lenses were used. Awards given to the EPSON PhotoPC, the first in the line of Epson color digital cameras. EPSON is a registered trademark of Seiko Epson Corp. ColorTrue and ClearOptics are trademarks of Epson America, Inc. All other trademarks are the property of their respective owners. ©1996 Epson America, Inc.

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Digital Cameras

Canon Computer Systems Inc.

PowerShot 600



If you need superior images for demanding business and desktop publishing applications, look to the Canon PowerShot 600. At \$950 (street), it's priced in the upper range for what we would consider an entry-level device, but its output quality and feature set make it worth the step up.

The PowerShot 600 achieves such outstanding results by combining two features: the highest resolution in this roundup (832-by-608) and a Custom mode that lets you save the image data uncompressed. The result is perceptibly



BREAK FROM THE PACK: The PowerShot 600's unique capabilities yielded the best images we've seen.

sharper images that hold up better to postprocessing than those of the rest of the pack. Colors in our indoor and outdoor test images tended to be more subdued than those shot with other digital cameras, but detail and exposure were excellent. Only large areas of white and off-white displayed the mottled look typical of 24-bit CCD captures.

The camera also offered a unique shooting experience. Although a point-and-shoot automatic, the PowerShot 600's size and weight (14 ounces) more closely resemble Canon's standard EOS Rebel X line. If you prefer the feel of an SLR, you'll probably find it quite comfortable.

Think of the PowerShot 600 as the Barbie of filmless cameras: It accessorizes well. For instance, it includes a built-in microphone for adding voice annotations. To upload images to the PC, you pop it in the small docking station. This helps pre-

vent you from accidentally knocking the camera off the desk.

Though not yet available during our testing, its optional (and, sadly, proprietary) wide-angle converter provides 28-mm equivalence, adapting the viewfinder as well. And because it accepts standard PC Cards for image storage, the PowerShot 600 stands up to serious on-the-go shooting better than others do. This goes for the software bundle as well. It includes a nicely designed, easy-to-use Twain driver and an excellent low-end image-editing package, Ulead PhotoImpact.

Unfortunately, this camera suffers from one shooting irritant: It takes far too long—several seconds—between the shutter press and the image capture. And its nickel cadmium battery requires at least 12 hours of charging before you can snap your first shot.

The PowerShot 600 is ideal for serious users who need fine image quality from a rugged device but can't justify the cost of a several-thousand-dollar midrange camera.—*Lori Grunin*

PowerShot 600. Street price: \$950. Canon Computer Systems Inc., Costa Mesa, CA; 800-848-4123, 714-438-3000; www.ccsi.canon.com. Circle 443 on reader service card.

Casio Inc.

Casio QV-10A Plus

The Casio QV-10A Plus (\$699 list, \$400 street) gets high marks for low cost, ease of use, and a generally slick design but falls short on image quality. It is well suited for quick-and-dirty snapshots or applications that don't require magnification and in which detail is not critical.

At 7 ounces, the QV-10A Plus was the lightest of all the cameras we tested; it is the size of a small point-and-shoot camera. Its unique features include a lens set on a swivel mount that can rotate 270 degrees and a 1.8-inch color LCD that serves as both viewfinder and playback device. This arrangement lets you hold the camera at arm's length and pivot the lens for a better angle on shots. The camera can take up to 96 480-by-240 images, which are stored in its flash memory.



DO THE TWIST: The Casio QV-10A Plus sports a swivel-mounted lens for those tough-to-get angles.

To shoot with the QV-10A Plus, simply frame the subject and push the shutter button. The camera body fits the hand comfortably, and the controls are well positioned. The rotating lens and macro focus (as close as 6 inches) make quick work of close-up shots, though there is an awkward, 6-second delay as the image is stored. The QV-PC applet makes uploading images a snap and can be used to perform basic editing, such as color balancing and image cropping. Casio includes Adobe Photo-Deluxe for more complex image editing.

Don't plan on getting too fancy in your digital darkroom, though. Despite its many design details, the QV-10A Plus lacks the resolution to handle all but the least demanding photographic assignments. Its less-than-VGA output is fine, though, for ID pictures, quick shots of a scene, or small Web-page illustrations.

This camera likes plenty of light with good contrast. Under bright sun, it produced images with accurate colors, for both scenic views and skin tones. Under an overcast sky, however, the colors were dull. The low resolution in indoor settings results in dim illumination and weak contrast. The optional flash lit our office scene well and balanced the mix of light sources adequately. But the low-resolution images allowed little flexibility for image editing.

Overall, this camera has a good set of features and is well designed. Its color reproduction was at least comparable to that of others we tested. Its biggest drawback is its low resolution. If you don't require high-quality images, this camera is a low-cost alternative to film cameras or more expensive digital devices. The QV-100, expected to ship this winter for about \$100 more, will offer a 640-by-480 resolu-

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David.



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CIRCLE 378 ON READER SERVICE CARD

Guide to Digital Camera Output

The single most important factor in evaluating digital cameras is image quality. Graphics professionals have long judged photographs by using criteria (aside from purely aesthetic values) such as proper exposure and contrast, color fidelity, accurate and pleasing skin tones, detail, focus, depth of field, saturation, and other attributes. Digital photography has added new elements to this mixture. Unwanted effects like *pixelization* (the tendency of an image to break up into into blocky squares of color), noise and *artifacts* (incorrect points of color or light that were not in the original scene), color bleed, and *color aliasing* (the tendency for areas of color to break up at their edges) often crop up in final images.

What to Look for in Digital Images

Look for **natural skin tones** on our two models, with good detail in the shadows and highlights of the faces. On this overcast day, the cameras' flashes should have fired to provide proper illumination of the subjects.

Buildings in the skyline (like New York's famous Chrysler Building) should show **good detail**, with **sharp edges on lines**. Better

cameras can reproduce the textures of clothes, clouds, and skyscrapers without annoying noise or patterning.

Many of the digital cameras we tested had trouble reproducing the **vibrancy of colors** on this cloudy day; their CCDs are better suited for full sunlight. Still, the better cameras were able to capture rich, accurate colors;

others produced flat, washed-out images.

To provide a point of comparison for the digital camera images on the following pages, we photographed the same outdoor scene with a \$10 disposable 35-mm camera (below). Note how much clearer the film photo is, free of pixelization and other artifacts.



HOW WE TESTED

To test our 11 entry-level digital cameras, we created two fairly typical business shooting situations. To make the playing field as level as possible, we used each camera's default settings. We then evaluated the images according to both conventional and digital criteria. As a baseline for comparison, we used a \$10 disposable 35-mm camera and had the photos developed by an overnight processing lab.

In our indoor scene we had one model wear a red jacket and the other a neutral suit to help show how well the cameras interpret certain colors and textures. To check depth of field, we arranged various papers across the

desktop. We photographed the scene from a distance of 8 feet so we could see the differences in coverage area delivered by the camera lenses. For devices with zoom lenses or wide-angle/telephoto options, we used those capabilities to frame the subjects optimally.

Since we wanted to make the scene as true to life as possible, we lit it with a hodgepodge of light sources that would be found in a typical office environment: overhead fluorescents, daylight streaming in through the window, a studio tungsten light to simulate a desk lamp, and (for the nine devices that had it) the camera's built-in flash. This meant that, in theory, the cameras' light sensors would automatically detect the amount of ambient light and would pump out enough lumens to light the scene according to a predefined optimum programmed into the camera's firmware.

We shot the outdoor sample photo on a rooftop terrace of the building in midtown Manhattan where *PC Magazine* has its offices. Again, for those devices that had it, we used automatic fill flash to help soften shadows on the faces and increase overall color saturation.

WHAT THE IMAGES SHOW

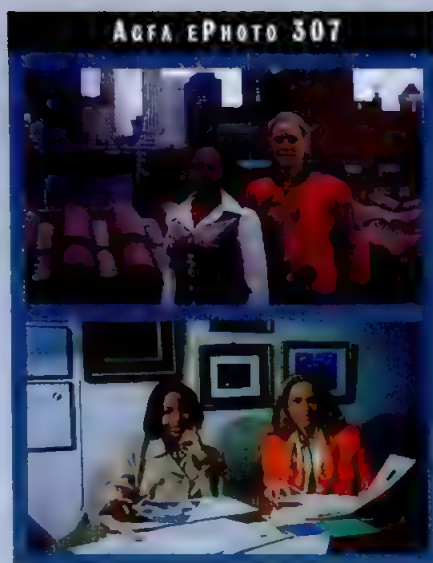
We were surprised at how poorly some of the digital cameras performed at their default settings, and how widely they interpreted color. Except for the Casio QV-10A Plus and Kodak DC20, we were able to improve image quality significantly by changing camera settings. Tweaking the images further in Photoshop helped rescue all but the worst images. All these cameras would benefit from more intelligent firmware that would let the cameras automatically adjust to shooting situations without requiring the user to change modes and settings.

Digital images from the indoor shot varied considerably. Best in show was the Canon PowerShot 600. It captured the sharpest picture with the greatest detail and best range of skin tones, and it was able to handle the difficult lighting with aplomb. The Casio's image exhibited harsh shadows, overexposed midtones, and (because of its inherent

low resolution) pronounced pixelization. The Kodak DC20's colors were washed out. Images from the Apple QuickTake 150, Epson Photo PC, and Kodak DC40 had an orange cast, which disappeared when we turned off the studio light and shot only with the cameras' own flashes and the ambient office light.

In an outdoor photograph of people, you usually want a camera's automatic flash to fire and give faces a bit of additional illumination, known as "fill lighting." Most of these cameras' flashes failed to go off outdoors; apparently they were confused by the brightness of the cloudy sky. Only the Kodak DC40's flash provided the correct amount of light to produce a pleasing, well-exposed portrait. Though the Casio's colors weren't perfect and it had no built-in flash, the exposure was excellent. Images from the Agfa ePhoto 307, Dycam Model 10C, Fujix DS-220, Kodak DC50, and Olympus D-200L were underexposed. The Canon picture had good detail, but color fidelity was a bit off.

While entry-level digital cameras are good and getting better, they leave considerable room for improvement. The CCDs need to capture a wider dynamic range of truly black shadows and crisp detail, pleasing and accurate midtones, and nicely detailed highlights and bright whites. Camera intelligence should be programmed to adjust automatically to a wider variety of lighting conditions.



HARDWARE

Digital Cameras



tion that may improve image quality substantially.—JK

Casio QV-10A Plus. List price: \$699. Casio Inc., Dover, NJ; 800-962-2746, 201-361-5400; www.casio.com. Circle 444 on reader service card.

Dycam Inc.

Dycam Model 10-C

The Dycam Model 10-C (\$799 direct) was selected as last year's Editors' Choice among digital cameras because it offered more features and better image quality than the competition. That explains why the 10-C remains a favorite with sales and service personnel, business users, and technical book producers. But

what was tops last year has slipped relative to newer, more sophisticated cameras that produce better images.

Except for color (light gray) and an elevated circular ring around the lens (for

screwing in 37-mm auxiliary lenses and filters), the 10-C is virtually identical to the Kodak DC50. That's not surprising, as Chinon manufactures the same body and optics for both companies.

The 10-C has an auto-focus lens with a 3X power zoom and 1MB of built-in memory, plus the ability to save to PC cards. Taking pictures is relatively easy. One annoyance is a 1-second delay between the time you press the shutter and the time when the image is actually captured. And while the hand strap gives welcome support, the 10-C's boxy shape makes it difficult to shoot one-handed.

On the control panel, there are three focus options: normal, spot, and macro. In addition, the 10-C has a zoom mode that you can set to manual (the default) or automatic.

Dycam's Picture Viewer software contains the most versatile and extensive set of tools among all entry-level digital cameras. It allows users to set a series of defaults (for sharpening pixels, increasing color saturation, and applying white balance, among other options) that it automatically applies to images when they're uploaded. Many settings are adjustable by simply plugging in new values or moving sliders.

In terms of picture quality, many other entry-level cameras now produce better results. In our indoor and outdoor test shots, colors appeared more subdued than we would have liked. Without the sharpness default set in the Preferences menu, images tended to exhibit a slight softness. A minor degree of pixelization also appeared along edges. Still, the 10-C's images are fine for displaying at screen resolution in Web pages, computer-based real-estate listings, and the like.

Because of the complexity of Dycam's software, casual, nontechnical users would probably prefer the similar Kodak DC50. But more sophisticated users who are bent on squeezing maximum quality from preupload image-editing

tools will find the Dycam Model 10-C a good choice.—DG and SWG

Dycam Model 10-C. Direct price: \$799.



A PERFECT VIEW: The Dycam Model 10-C's Picture Viewer software offers the most extensive set of tools among the entry-level digitals.

HARDWARE

Digital Cameras

Dycam Inc., Chatsworth, CA; 800-883-9226, 818-407-3960; www.dycam.com. Circle 445 on reader service card.

Eastman Kodak Co.

Kodak DC20, DC40, DC50



Eastman Kodak is digital photography's 800-pound gorilla, manufacturing and selling a wide range of filmless cameras priced from \$300 to over \$28,000. Its entry-level products, the Kodak DC20 (\$300 street), DC40 (\$600 street), and DC50 (\$900 street), are each designed for a different segment of the amateur market. The DC20 is targeted directly at families, especially kids. The DC40 will appeal to low-volume, budget-minded users looking for reasonable image quality, such as Web publishers and law enforcement officers. The DC50's more advanced features are geared toward niche users such as educational and medical

the DC20 is one sophisticated device. For example, a sensor continuously monitors the amount of light falling on the CCD and adjusts the capture speed to a value ranging from $1/30$



PIXEL-PERFECT: The DC40 delivered the best images of all the point-and-shoots in its price range, with strong highlights and pleasing mid-tones.

to $1/4,000$ second. If there is still inadequate light, it boosts the CCD's ISO sensitivity from 800 to 1,600 automatically.

Reflecting its push towards a youth-oriented market, Kodak bundles the DC20 with a special edition of PhotoEnhancer and Kai's Power GOO. While PhotoEnhancer is very light on image-editing tools, it includes templates and projects for dropping images into postcards and calendars. Power GOO is the electronic equivalent of finger paint, allowing users to warp images so they appear as fun-house mirror reflections.

As cute and interesting as the DC20 is, its low resolution means nothing appears in sharp focus if you enlarge the image beyond a size of 2 inches by 3 inches. Indoors, the lack of a flash means it overexposes the image, washing out the colors so much that a red jacket looked mauve pink. The camera fared much better in sunlight, however. Exposure was acceptable, and although the colors were not fully saturated, they appeared with more fidelity.

With the DC20, don't look for sparkling image quality. But it's a quick, easy, and fun way for your family to take photos and get them into a computer.

At about double the price, the DC40 (\$600 street) represents enough of an improvement in features and image quality that it's still a good value and merits an Editors' Choice. Although it's still a basic point-and-shoot camera (lacking a

zoom lens and an LCD viewer), the DC40 offers 756-by-504 resolution and better image quality than other cameras in its price range. Though it doesn't support PC cards, its 4MB of internal memory can capture up to 48 low-compression images.

A built-in hand strap makes one-hand shooting easy. The LCD panel is painless to configure and simple to read.

The DC40 version of PhotoEnhancer provides a useful range of preupload tools and permits adjustments for bright and cloudy daylight, incandescent lighting, and fluorescent lighting. Surprisingly, all of the thumbnails appeared blurred, even if the full images were sharp.

Overall, the DC40 produced excellent results. Our test images exhibited strong highlights and pleasing midtones, though clips in the shadows appeared dark and muddy. The DC40 was the only camera we saw that automatically adjusted the fill flash to expose both faces and the background correctly on our outdoor test, though edges that should have appeared sharp exhibited some pixelization.

Still, its combination of low price, easy operation, and superior image quality in its price range all make the DC40 an outstanding value.

Kodak's most versatile entry-level model, the DC50 (\$900 street) has a resolution of 756-by-504, an auto-focus lens and 3X power zoom, macro capability that focuses to 19 feet, and PC Card support. The camera's 1MB of built-in memory stores up to seven low-



VERY VERSATILE: The DC50 features a zoom/macro lens, PC Card support, and a juiced-up version of PhotoEnhancer.



FAMILY FUN: The DC20 is the smallest and cutest digital camera on the market. Kids will love its ease of use and bundled software.

personnel who require swappable storage media or macro capability.

The smallest, least expensive digital camera on the market, the palm-size DC20 also features one of the lowest resolutions in this roundup: 493-by-373. This no-frills device lacks standard features like a built-in flash, a frame counter, or a self-timer. With no parameters to change or options to select, shooting with the DC20 is a no-brainer. There are only three buttons: on/off, erase, and the shutter. In high-resolution mode, the DC20's 1MB of built-in memory stores up to eight images.

But underneath its toylike appearance,



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SUMMARY OF FEATURES

Digital Cameras

PC MAGAZINE
EDITOR'S CHOICE

PC MAGAZINE
EDITOR'S CHOICE

■ YES □ NO □ OPTIONAL

Products listed in alphabetical order

	AGFA ePhoto 307	Apple QuickTake 150	Canon PowerShot 600	Casio QV-10A plus	Dycam Model 10-C	Eastman Kodak DC20	Eastman Kodak DC40	Eastman Kodak DC50
List/street price	N/A, \$600	N/A, \$600	N/A, \$950	N/A, \$400	\$799 direct, N/A	N/A, \$300	N/A, \$600	N/A, \$900
Weight (without cables or case, in ounces)	13	16	14	7	22	4	16	22
Macintosh interface	■	□ (\$89)	■	■	□ (\$99)	■	■	■
Photographic Specification								
Viewfinder type	Optical	Optical	Optical	LCD	Optical	Optical	Optical	Optical
Lens type	Fixed focus	Fixed focus	Auto-focus	Auto-focus	Auto-focus zoom	Fixed focus	Fixed focus	Auto-focus zoom
35-mm equivalent lens size (millimeters)	43	50	50	60	38-114	47	42	37-111
Focusing range	24"-infinity	4"-infinity	4"-infinity	7"-infinity	19"-infinity	19"-infinity	48"-infinity	19"-infinity
Automatic exposure compensation	■	■	■	■	■	■	■	■
ISO equivalency	130	85	100	100	150	800, 1,600	84	84
Built-in flash	■	■	■	■	■	■	■	■
Reset time	6 seconds	7 seconds	5 seconds	N/A	5 seconds	N/A	6 seconds	6 seconds
Image Capture								
Image resolution (best quality, in pixels)	640 x 480	640 x 480	832 x 608	480 x 240	640 x 480	493 x 373	756 x 504	756 x 504
File size (best quality)	900K	900K	800K	350K	900K	550K	1.1MB	1.1MB
Type of compression	JPEG	JPEG	JPEG	JPEG	JPEG	Proprietary	Proprietary	Proprietary
Internal storage capacity and type	2MB flash RAM	1MB flash EPROM	1MB flash RAM	2MB flash RAM	1MB flash RAM	1MB flash RAM	4MB flash RAM	1MB flash RAM
Accepts supplemental memory cards	■	■	■	■	■	■	■	■
Number of images that can be stored:								
High-resolution	36	16	4	96	5	8	48	7
Medium-resolution	N/A	N/A	16	96	10	N/A	N/A	11
Low-resolution	72	32	17	96	40	16	99	22
User can delete latest frame from memory	■	■	■	■	■	■	■	■
User can delete selected frames from memory	■	■	■	■	■	■	■	■
Battery type	AA alkaline	AA lithium	Nickel cadmium	AA lithium	AA alkaline	3-volt lithium	AA alkaline	AA lithium
Estimated shots per charge (with flash)	200	100	300	200 (no flash)	175	250 (no flash)	300	260
Can use standard alkaline batteries	■	■	■	■	■	■	■	■
Price of supplemental battery pack	\$79	\$49	\$35	N/A	N/A	N/A	\$59	\$59
Image Manipulation								
Computer interface	Serial	Serial	Parallel	Serial	Serial	Serial	Serial	Serial
Digital input/output	■	■	■	■	■	■	■	■
Video input/output	■	■	■	■	■	■	■	■
Image-editing software included	Adobe PhotoDeluxe, Agfa PhotoWise	QuickTake Image Access	Ulead PhotoImpact 3.0	Adobe PhotoDeluxe	Dycam Picture Viewer	PhotoEnhancer	PhotoEnhancer	PhotoEnhancer
Other software included	None	Twain driver	PowerShot, Twain driver	QV-PC	None	Kai's Power GOO, Kodak Picture Easy	None	None
Service and Support								
Toll-free technical support	■	■	■	■	■	■	■	■
Technical-support hours (eastern time)	9:00-8:00 M-F	8:00-8:00 M-F	6:00 A.M.-12:00 midnight, 7 days	9:00-5:00 M-F	10:00-8:00 M-F	9:00-8:00 M-F	9:00-8:00 M-F	9:00-8:00 M-F
Warranty (parts and labor)	1 year	1 year	1 year	1 year	1 year	1 year	1 year	1 year
Web address	www.agfa.com	www.apple.com	www.ccsi.canon.com	www.casio.com	www.dycam.com	www.kodak.com	www.kodak.com	www.kodak.com

N/A—Not applicable. The product does not have this feature

compression images, and a 4MB PC Card (\$230) increases its total capacity to 35 shots.

The unit is identical to the Dycam Model 10-C in all but its shade of gray (the Kodak unit is darker), and the zoom/shutter buttons make it possible, if awkward, to shoot one-handed. The LCD panel icons are well organized and

self-explanatory.

Kodak provides a DC50-specific version of PhotoEnhancer that is nearly identical to the one included with the DC40, except that it offers slightly more functionality for controlling the camera from the computer.

On our tests, the DC50's images were sharp and detailed, exhibiting only a min-

imum of pixelization. Colors were generally accurate and well saturated. Though the camera does not react well to studio lights (it created a blue or pink cast, depending on the type of illumination we used), exposure and color are excellent when its own flash is implemented.

The DC50's zoom/macro lens and removable media make it a strong all-

Digital Cameras

Epson America Inc.

PhotoPC

Epson may not be a camera company like Canon or Olympus, but the image quality from its PhotoPC (\$400 street) attests to a long history in the image-capture market. The PhotoPC should prove fine for hobbyists, Web captures, and the like, providing picture quality comparable to that of slightly more expensive cameras. In exchange it sacrifices storage space and ergonomics.

Weighing in at 1 and a half pounds and sporting a comfortable rubber grip, the PhotoPC feels solid in your hands. One trade-off for the low price, though, is rather limited storage capacity; with its standard 1MB of RAM, its 32-shot maximum doesn't even match the number of shots in a roll of film. You can pay extra to expand the memory to 2MB (\$199) or 4MB (\$299), but that eliminates the PhotoPC's cost advantage over competing cameras.

Epson bundles the serviceable EasyPhoto software along with an adequate Twain driver. The driver lets you preview and capture images in tethered mode, but we found the preview update too slow to work with anything other than still lifes; even a person posing would move too much to operate this way. EasyPhoto gives you adequate image-editing tools and is a good package for novice users who don't want to wade through complex features they will never use.

On our tests, the PhotoPC's images showed good contrast and excellent color quality both in natural light and with the camera's flash. On the other hand, the PhotoPC's limited exposure range renders it less flexible than many of its competitors; with the combination of a minimum shutter speed of 1/30 second and a maximum aperture of f/5.6, you'll find yourself using the flash more often than not. Similarly, the 43-mm-equivalent lens made it difficult for us to frame our shots properly; the lens is not quite wide enough to frame a good landscape, and not quite narrow enough for a

natural head shot or close-up. (Epson offers a 37-mm-equivalent lens.)

The PhotoPC is one of the older cameras in this roundup, and in the near future Epson will be releasing a new camera with a feature set more comparable to those of its current competitors (while keeping the present PhotoPC on the



A SMART BUY: The PhotoPC's image quality beats out all others in its price range, and its EasyPhoto software gives novice users an intelligent mix of features.

market at this price). For now, the PhotoPC offers better image quality than others in its price range, but if you plan to use a digital camera more than occasionally you'll want to opt for one of the more expensive, feature-rich units.—LG

PhotoPC. Street price: \$400. Epson America Inc., Torrance, CA; 800-289-3776, 310-782-0770; www.epson.com. Circle 447 on reader service card.

Fuji Photo Film USA Inc.

Fujix DS-220

If you are past the point-and-shoot stage of digital photography but don't have the budget for a multithousand-dollar professional outfit, consider Fuji's Fujix DS-220. For \$1,200 (street) you get a product that performs as well as some midrange models.

The DS-220 looks like a small camcorder turned sideways. But this camera is not as simple an affair as most of the other entry-level units we reviewed, so plan on reading the manual and practicing a bit before putting the DS-220 to work. Once you figure out the controls, though, it's easy to use. In bright light the unit takes about a second to store a shot

Epson PhotoPC	Fuji Fujix DS-220	Olympus D-200L
\$499, \$400	N/A, \$1,200	\$749, \$600
27	17	10
□ (\$69)	■	■
Optical	Optical (optional LCD)	(Optical/LCD)
Fixed focus	Auto-focus	Fixed focus
45	36.72	5
24"-infinity	18"-infinity	8"-infinity
■	■	■
130	120, 240	130
■	■	■
5 seconds	3 seconds	6 seconds
640 x 480	640 x 480	640 x 480
200K	200K	900K
JPEG	JPEG	JPEG
1MB flash RAM	1MB flash RAM	3MB flash RAM
■	■	■
16	10	20
N/A	20	N/A
32	40	80
■	■	■
AA alkaline	AA lithium	AA alkaline
Info not available	200	130
■	■	■
N/A	\$50	N/A
Serial	Serial	Serial
■ ■	■ ■	■ ■
EasyPhoto	Image AXS	Adobe PhotoDeluxe
None	None	Twain driver
■	■	■
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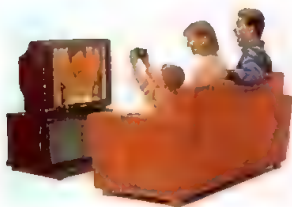
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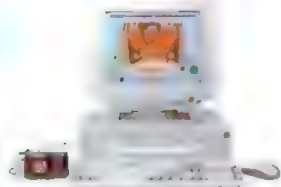
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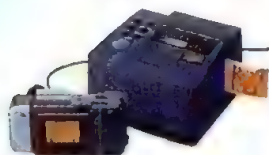
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MIDRANGE CONTENDER: *The Fujix DS-220 will have you shooting like the pros, despite its convoluted software.*

and about 5 seconds to recycle after the flash is fully extended.

The optional 2-inch diagonal LCD screen (\$299) lets you view images already in memory, and you can also use it as a viewfinder.

As well designed as the DS-220 is, its labeling, software, and documentation leave plenty to be desired. Even if you

are proficient at programming old VCRs, it still presents a real challenge. For example, Fuji positioned the button you push to upload images next to lettering reading "erase," and the manual offers little assurance that pushing "erase" will not send your images into virtual unreality. The manual is chock-full of unenlightening statements such as "When Read Camera List is selected from the File Menu, the Reception Index window is displayed."

The user interface of Fuji's IF-D22/PC software is equally convoluted. Menus and options are poorly designed, and the steps used to retrieve and save images are poorly explained. The program automatically assigns images numbered filenames that you cannot rename from within the program.

Despite these complaints, the DS-220 produced impressive images. On our tests, skin tones were natural, and in full sunlight colors were vibrant with good

contrast. The flash did a good job of lighting subjects within its 10-foot range.

This camera may cost a bit more than some of its competitors, but it offers more than run-of-the-mill features. The enhanced control over the photographic process and its close-focus ability will appeal to users who plan to do more than just take snapshots for Web pages or ID cards. Although the weak software detracts from its value, if you pair it with a program such as Adobe Photoshop, this camera will be a real contender.—JK

Fujix DS-220. Street price: \$1,200. Fuji Photo Film USA Inc., Elmsford, NY; 800-378-3854, 914-789-8100; on CompuServe: GO FUJI. Circle 448 on reader service card.

Olympus America Inc.

Olympus D-200L

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picture quality is pretty impressive as well. For more tax-deductible purposes, such as generating images for business-oriented Web sites and low-resolution printed materials, it offers an excellent value.

We found it exceptionally easy to frame shots with the D-200L, which is lightweight and easy to grip. Though you can preview images with the built-in LCD screen as well as with the viewfinder, the LCD didn't update the view quickly enough to function this way effectively. And we found the LCD impossible to keep clean; for instance, when shooting using portrait orientation, we kept leaving nose prints on the screen.

On the other hand, the display comes in very handy for scrolling through and clearing out captured images. The camera also lets you lock individual images to prevent accidental erasure—a nice touch.

Although the D-200L's images couldn't compete with those from the class-leading Canon PowerShot in

terms of crispness, the D-200L displays excellent exposure and color control, especially under natural light. In its best mode (640-by-480 resolution), the pictures appeared pleasing for on-screen display, with only a minimal touch of the blurriness that is characteristic of JPEG compression. The D-200L produced excellent skin tones and handled light colors well, but it tended to oversaturate reds garishly.

The software bundled with the camera evoked a



GRAB AND SHOOT: Framing shots is a breeze with the Olympus D-200L. Preview them by way of the viewfinder or the LCD screen.

more lukewarm response. The D-200L's serviceable Twain driver includes the ability to capture images while tethered to the PC, but the preview suffers from the same time-lag problem as the LCD viewfinder. It also ships with Adobe PhotoDeluxe, which has a major flaw with respect to digital cameras: Because it supports only a single open image at a time, you can't download images in batches. (The Twain driver, however, does support multiple downloads.)

The D-200L is a fun, easy-to-use camera and a great buy for low-resolution business tasks such as Web publishing. The D-200L's big brother, the higher-resolution (1,024-by-768), higher-priced (\$900 street) D-300L didn't ship in time for this story. But if resolution matters to you, you may want to keep an eye out for it.—LG □

Olympus D-200L. Street price: \$600. Olympus America Inc., Melville, NY; 800-622-6372, 516-844-5000; www.olympus.com/digital. Circle 449 on reader service card.

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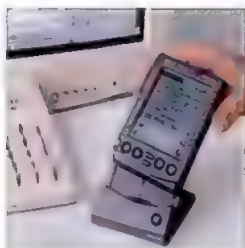
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A new generation of programming tools puts muscle behind the promise of Java.

By Richard V. Dragan Scarcely a year old, Sun Microsystems' Java programming language is poised to alter the face of computing. The Java virtual machine (VM), Java's native operating environment, offers the closest thing we've seen to the Holy Grail of platform independence. Java's safer language features, such as built-in garbage collection and the elimination of pointers, offer an elegant, up-to-date interpretation of C++ without that language's worst traps.

Java's native network awareness makes it a natural for distributed applications. Finally, the new JavaBeans component specification promises to make Java RAD (rapid applications development) programming a practical reality. Taken together, these features are rocking the programming world.

With so much new to offer, it's no wonder that Java has caught on like wildfire with programmers. The proliferation of Java applets on



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JAVA TOOLS

Highlights

Java seems well on its way to fulfilling a number of grand old dreams that the industry had all but abandoned. It delivers the closest thing we've ever seen to true platform independence, both from operating systems and from processor architectures. It delivers the power of object orientation without the arcana of C++. It is also inherently network-oriented and promises to extend the wired world to everything from PCs to TVs. The first Java tools, beginning with the Sun JDK, were primitive but wildly popular. Second-generation tools, reviewed in this story, are far more polished and robust

JavaBeans are poised to change Java development dramatically. Finally, Java will have a standard for reusable plug-in components along the lines of ActiveX. JavaBeans will be able to expose their

properties and methods to intelligent design tools and even supply their own design-time functionality, such as wizards. Because they are written in Java, they will be portable to any implementation of the Java VM. The JavaBeans specification went final only at press time, but some products in this story, such as Symantec Visual Café, already include JavaBeans-like components. We expect all Java tools—with the possible exception of Microsoft Visual J++—to adopt JavaBeans quickly as their native components

Is Java a 4GL? Technically, no, but we found that some tools, such as Visual Café, took a very RAD-like approach typical of 4GL systems, where you can set properties and attach events within a visual design environment. Others, such as Microsoft Visual J++, take a much more traditional approach typical of

classic C++ development tools. IBM's VisualAge for Java takes visual programming to the extreme with a complete construction-from-parts metaphor derived from Smalltalk programming tools.

We missed a number of upcoming tools that were unavailable for full review but may be available in beta or final release by the time you read this. To give you a sense of what's on the horizon, we include looks at upcoming tools from Asymetrix, Borland, IBM, and Powersoft.

Compiler performance is less an issue than it used to be, but we still took a rigorous look at the products. Our performance tests cover build times, compiled code size, and speed of execution. We ran our execution-speed tests within each tool's own runtime VM, and within Microsoft and Netscape browsers.

the Web is only the most obvious measure of its popularity. Many early applets were created with Sun's Java Development Kit (JDK), the first set of tools available for Java development. The applets were typically lightweight animations, but even those could be tough to build with the JDK's primitive facilities. For more complex applets, let alone standalone Java applications, developers needed more advanced tools. Those tools are finally here.

WHAT WE REVIEWED

This article charts the current state of Java development systems. At press time, three were publicly available and therefore eligible for full review: Java WorkShop, from Sun; Microsoft Visual J++, from Microsoft Corp.; and Visual Café, from Symantec Corp. One of these, Visual Café, was in a late beta release freely accessible from Symantec's Web site. Surprisingly, it proved as feature-rich and stable as many final-release tools we've seen.

Four additional Java tools from Asymetrix Corp., Borland International, IBM Corp., and Powersoft narrowly missed our cutoff, although the companies made limited beta releases available to us. Those products, discussed in sidebars, should be available by the time you read this or shortly thereafter. We did not review Java development systems whose compile/debug facilities are based on an

unenanced Sun JDK implementation.

Whether shipping or still under construction, the products discussed here offer unmistakable evidence that tradi-

tional C++ and RAD tools are in for stiff competition. Java development packages are ready for real work, and they're out to make traditional programming obsolete.



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VISUAL RAD APPROACH

As a group, the new Java tools are moving away from a code-intensive, do-it-yourself approach and toward visual programming metaphors. In the most advanced, you assemble prefabricated components in a GUI environment that lets you access the components' properties and methods directly. The approach is familiar to users of tools such as Microsoft Visual Basic but is new to languages based on C++.

Symantec's Visual Café 1.0 gives us the first look at Sun's JavaBeans component model. Borland's OPEN JBuilder and Powersoft's Star Buck, both still in development at press time, will also offer JavaBeans support. IBM's VisualAge for Java will offer several kinds of components, including OpenDoc parts as well as JavaBeans. Microsoft Visual J++ 1.0 offers high-level access to any ActiveX components through Java (although the company has not yet announced whether it will support JavaBeans directly).

Of the tools we reviewed, Visual Café offers the most advanced visual programming features. In addition to giving direct access to events, its Interaction Wizard helps programmers generate basic events

through an English-language interface. Other products headed in similar directions include Open JBuilder and Star Buck. VisualAge for Java will deliver a full-blown visual construction-from-parts approach, with the visual layout as a metaphor for program flow.

One of the common drawbacks of traditional RAD tools is their weak debugging capabilities. Java tools break out of this mold, offering pedal-to-the-metal debuggers more reminiscent of those included with C++ compilers. While most Java environments still depend on a lightweight applet viewer as a runtime debugging environment, Microsoft Visual J++ supports the debugging hooks in the company's Internet Explorer, giving you the power of a real-world browser as a debugging tool (Visual Café will support Netscape Navigator-hosted debugging in future releases).

Sun's Java WorkShop 1.0 takes integrated browser debugging one step further. The entire development environment is written in Java and HTML and runs inside a browser-like environment. Sun's approach makes Java WorkShop highly portable and showcases one of the most sophisticated implementations of Java applications programming so far.

Overall, we found that the Java tools streamlined the time-consuming edit/compile/run/debug cycle of languages like C++. Our code compiled quickly on all platforms and was running in the debugger within seconds (for details on compiler performance, see the performance tests).

THE END OF C++?

A surprising trend we discovered in the course of this roundup was a clear consensus among vendors that Java will eventually eclipse C++ as the premier general-purpose programming language for business. Java solves several of the chronic problems of C++ development with its removal of pointers from the language and its built-in garbage collection, thus eliminating several classes of hard-to-detect bugs common in C++ programs.

Our Contributors: RICHARD V. DRAGAN is a programmer and LARRY SELTZER is a technical director at PC Magazine Labs. KAARE CHRISTIAN is a Java and C++ programmer. THOMAS MACE was the senior editor in charge of this story, and JAY MUNRO was the project leader.

Editors' Choice

• Visual Café



Java tools are maturing fast, but none faster than

Symantec's Visual Café 1.0. Its release number notwithstanding, Visual Café is a second-generation tool that builds on core technology from the company's earlier Symantec Café product. What it adds is a powerful visual programming metaphor that takes Java far from traditional C++ language tools and into the realm of RAD.

Visual Café includes a large collection of reusable controls that closely parallel the JavaBeans specification. You program with these components visually, dragging them onto forms, setting their properties and attaching events directly. Just as important—and unique to Visual Café—is that the design of visual resources is a two-way street. Any changes you make to the generated UI code are reflected immediately in the visual representation.

Another significant productivity feature, the Interaction Wizard, analyzes the possible interaction between two components when you drop one onto another. Visual Café generates a series of English-language statements that help you generate basic events automatically, an approach that hints at Smalltalk-style visual construction from parts. Overall, Visual



Café gives you excellent control over your project, which you can view as a class hierarchy or by its objects' members, methods, and source code.

This is the first time *PC Magazine* has given its Editors' Choice award to a beta release of a programming tool. Visual Café was publicly available on the World Wide Web during our testing cycle, and it proved to be as stable and bug-free as many shipping tools we've seen in the past. We found it clearly the most productive of the products reviewed here, despite its beta status.

Sun's Java WorkShop has some of the rough edges of a first-generation product, but it breaks new ground by being written almost entirely in Java and HTML. Its handsome interface is conceived around hyperlinks, provides browser-style navigation, and blurs the distinction between local and Internet-based project repositories. More than just a proof of concept, Java WorkShop is a real tool that will appeal to many.

Microsoft Visual J++ offers a conservative 3GL approach to Java development, but its tools proved to be solid and its compiler technology is fast. Its debugging, through Microsoft Internet Explorer 3.0's debugging API, was particularly rich. Not surprisingly, Visual J++ integrates tightly with ActiveX, automatically wrapping ActiveX components in a Java interface. You can even use Visual J++ to create ActiveX components in Java, showing that the two can peacefully coexist. Visual J++ lags in the race to harness objects through visual tools, but its traditional C++ style is very robust.

Many vendors also described plans for Java compilers that generate native machine code, meaning that you will soon be able to use Java to target x86 Intel applications in addition to platform-independent bytecode executables. Microsoft has even hinted that it will provide higher-level Java encapsulations of the Windows API along the lines of its C++ Microsoft Foundation Classes, although it has not announced specific products or dates. Already large on the

Web, Java's influence will grow for native code development, extending into Windows-based software.

For the nearer term, the most significant change in the Java landscape is the release of Sun's JavaBeans specification, which appeared just as we went to press. The JavaBeans component model will provide a standard for preprogrammed Java building blocks. As such, JavaBeans will resemble the ActiveX components used by Windows developers. JavaBeans will let tool vendors ship basic components with their products—widgets that will help speed the development of a host of standard elements—from database fields to image containers. We also expect

to see a third-party market in JavaBean components of the sort that has grown up around ActiveX. JavaBeans rely on the Sun JDK Version 1.1, still in development at press time but due for release soon (for details on the JavaBeans specification, see the sidebar "Java Components: JavaBeans Arrive").

Another recent development sure to have an impact on Java products is the new Java Database Connectivity (JDBC) classes from Sun. Of the products reviewed here, only Microsoft Visual J++ comes with database connectivity straight out of the box, and that's through ActiveX. But Microsoft will not be alone for long. Database connectivity on the Web has the advantage of requiring only a thin client that is easily deployable for any user in a Web browser. That will surely make Java-centered database applications an attractive option for corporate developers, and tool vendors are ready to oblige.

BUILD IT IN JAVA

Whatever your background, whether RAD database programmer, Web designer, or C++ developer, you'll find a Java tool that suits your habits and makes you productive right now. The reviews, test results, suitability-to-task ratings, and sidebars that follow should give you a clear insight into the current crop of tools and details on new releases expected over the next few months. With Internet product cycles spinning ever faster, it's a great time to start thinking about building your next project with Java.

Sun Microsystems

Java WorkShop

ALL REVIEWS BY RICHARD V. DRAGAN

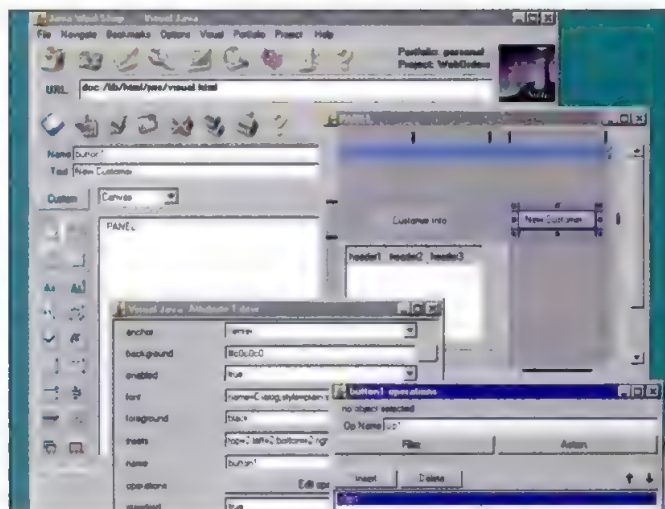
An intriguing product built for the Internet age, Sun Microsystems' Java WorkShop 1.0 is written almost entirely in Java and HTML and runs inside a browser-like environment ultimately derived from Sun's HotJava Web browser. Its radical design makes Java WorkShop highly portable. The same HTML and Java components from the distribution CD run under Microsoft Windows 95, Windows NT, and Sun Solaris 2.4; the only platform-specific elements are the Java virtual machine (VM) itself and some compiler components from the Sun Java Development Kit (JDK). The only real downside of this design is that it raises the hardware requirements for the development platform (we found you'll need 32MB of RAM for acceptable performance).

This first release has many impressive features and delivers considerable functionality in a handsomely designed interface. It also suffers from a few surprising

omissions we hope will be addressed in subsequent releases.

BROWSER ENVIRONMENT

The Java WorkShop user interface, with its large, colorful icons, has an intuitive, Web-like feel. Screens resemble Web pages; you navigate through them using standard



In Java WorkShop, you design interfaces with standard and custom Java components using the AWT layout managers.

browser controls. One big advantage of the tool-inside-a-browser approach is that you can debug your Java components within the host environment without having to launch a separate applet viewer or third-party browser. The unusual interface takes some getting used to, but we found it quite polished and functional. One quirk of the HTML-based approach is that windows cannot be forced to stay on top of other

JAVA TOOLS

How to Read the Suitability to Task Boxes

User interface design To evaluate this task, we look at the tool's capabilities for designing user interfaces, beginning with its overall ease of use. We look in particular for two-way forms creation, which allows code to be customized without losing the ability to modify the layout through the visual tool. This ability is especially important in Java, where there is no concept of resources, and controls must be created from code statements. The use of a visual construction-from-parts metaphor is also a plus.

Rapid applications development This task involves the 4GL-like features of the tool that adapt it

SUITABILITY TO TASK		
Product name		
	Power	Ease
User interface design	Excellent	Fair
Rapid applications development	Good	Good
Debugging	Fair	Excellent

to rapid development. We look for a JavaBeans-like or ActiveX component model and a good collection of reusable components. The ability to add event handlers directly to the controls themselves is a plus. We also look at the power and flexibility of wizard-driven code generation for applets and applications.

A rich set of project management features providing multiple views of the project by files, classes, and class hierarchies is also a consideration here. Finally, we look for a customizable code editor with syntax highlighting and printing support.

Debugging Here, we rate the overall quality of the debugging tools, including the ability to set watches, breakpoints, threads, and exceptions. Debuggers that support pop-up data inspectors for examining the values of variables on the fly are a plus, as is support for debugging hooks in real-world Java browsers.

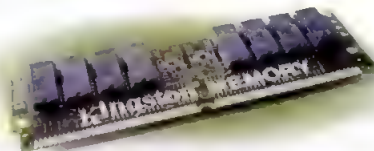


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Java Components: JavaBeans Arrive

By Richard V. Dragan

The wagons are circling around Microsoft's ActiveX, as companies including Apple, Borland, IBM, Lotus, Netscape, Novell, and Symantec line up behind Sun Microsystems' newly published JavaBeans 1.0 component standard. The specification for reusable, prebuilt Java software components represents the most significant advance for Java since its first release over a year ago. While not yet fully implemented in development tools, the JavaBeans spec makes reusable Java components a reality, securing Java's position as the central platform for Web development.

ACTIVEX-LIKE ROLE

JavaBeans will be small visual components created and sold by third-party tool vendors. As such, JavaBeans are poised to play the same vital role for Java programming that OCX and ActiveX have played in Windows development.

Unlike ActiveX components, which can be created using a variety of languages, JavaBeans are not language-independent; they're built with Java. Because of that language dependence, however, JavaBeans are platform-independent. A JavaBean relies on Java language conventions and enhancements in the new version of JDK 1.1 to implement several key facilities.

One of the most important is the ability to tell the toolkit consuming a JavaBean what methods and properties and events are available. That's called *introspection*, which JavaBeans support in two principal ways. First, a BeanInfo

class provides a place where a component developer can put specific information about what a JavaBean can do. Second, toolkits using JavaBeans can read properties, methods, and events by examining a JavaBean's interface through the Java Core Reflection API. This extremely clever, no-muss, no-fuss convention lets any JavaBean-compliant tool know what's going on inside a



JavaBean component. By naming methods with certain conventions, JavaBean creators in effect are publishing their capabilities to the world.

JavaBeans also offer new support for managing events. Any component can be marked as a listener for certain events, and events can be sent to single or multiple components. Instead of relying on inheritance, JDK 1.1 processes events by delegation, a simpler and more flexible arrangement. Once again, by declaring a method that requests a particular event, a JavaBean lets other Java code know what events it wants to process.

One of the niftiest JavaBean features is support for a split between

design-time and runtime functionality. That means, for instance, that a JavaBean can provide its own wizard or property sheet to help a toolkit user do the design work. At runtime, the design-time functionality is not downloaded. The toolkit lets the JavaBean do its own design work, if possible, and fills in the default design support when necessary. With this elegant and potentially very powerful feature, component vendors will be able to differentiate their offerings.

This first JavaBeans specification provides for serialization of components. That means that JavaBeans know how to save and restore themselves to a disk or a remote URL. In addition, JAR files can store other resources, such as images or multimedia. Structured storage, where embedded objects know how to store compound embedded documents, is not included. But with hooks to CORBA, JavaBeans may evolve to rival other higher-level document-sharing methods.

With any new technology, the proof is in the implementation, not the specification. In the products reviewed here, only Symantec's Visual Café (which uses an interim release of Sun's JDK 1.0.2) offers preliminary JavaBeans support. But with a market hungry for real-world Java components, we expect all major vendors to deliver JavaBeans support very soon. Instead of programming with AWT directly, developers will soon have prebuilt JavaBean components to choose from and powerful RAD tools to manage them. With JavaBeans, Java will grow up fast.

views. That makes a high-resolution screen mode a necessity, so that you can have multiple windows open on different parts of your display without having to layer them on top of one another.

Java WorkShop's approach to project management is also extremely Web-oriented. Projects are managed in Portfolios. They can reside in a local file system or on a Web server anywhere on the Internet,

so it's a snap to share or publish source code using the Internet as a transport. Java WorkShop gives you extensive support for managing, copying, or moving Portfolios as needed.

The Project Manager generates default skeleton projects for applets or applications. You can use any existing Portfolio, local or remote, as the basis of a new project.

Once you've defined a project, you use the Visual Java design tool to develop the visual aspects of your program. This tool lets you place any AWT or custom class into your projects. Java WorkShop supports the basic AWT component types, like buttons and labels, as well as some custom types, such as tab controls and images.

The Visual Java interface relies on the layout managers in the AWT for placing

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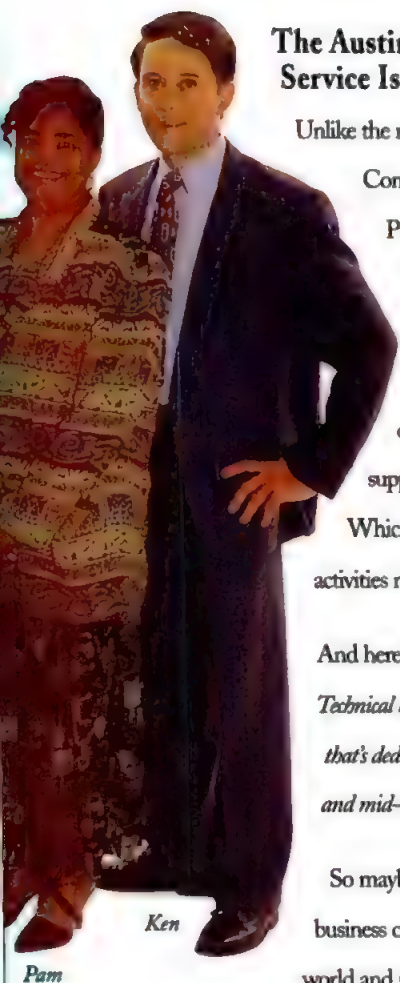
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PERFORMANCE TESTS

Java Tools



While all the products delivered reasonable compiler performance, we did uncover significant differences in build times, executable sizes, and code execution that could prove significant for some real-world projects.

How We Tested

To test the performance of Java development environments, we used JMark 1.01, PC Magazine Labs' Java performance test suite. We measured the time each development environment took to compile these tests, the size of executables generated, and the performance of those executables in a variety of Java VMs.

JMark 1.01 consists of 19 Java source files ranging in size from 840 to 15,937 bytes. For our **Build Speed** tests, we defined all these files as a project in the development environment, deleted any previously generated executables, and timed how long it took to build the executable files. The **Full Debug Build** result shows the build time for the entire JMark project. The **Incremental Debug Build** result shows the build time for the project's largest file. Between test runs, we defragmented the hard disk and rebooted the system. The **Executable Size** test files were generated with debug options turned off. We report only 6 representative scores out of the 19 Executable Size test results we generated, since the pattern of results across all three products was remarkably consistent from file to file.

The **AWT Graphics Mix** test, our first test of execution speed, performs a workout of the APIs of the Java Advanced Windowing Toolkit (AWT) Graphics class. A variety of graphics operations are performed sequentially, including the drawing of lines, rectangles, rounded rectangles, ellipses, and polygons, and the drawing of text using different fonts. The **AWT Blts/Images** test measures the

speed of bit-block transfers of graphics data on-screen. The test first uses AWT calls to display two different-size images, then uses the copyArea method to copy the image around the screen.

The next three tests, **Vectors**, **Hash Table**, and **Stack**, measure the performance of several of the Java container classes, which provide powerful and simple access to common data structures.

As a group, the next four tests were ported from the Stanford Unix benchmark tests. **Bubble Sort** and **Quick Sort** implement those well-known algorithms. The version of **Towers of Hanoi** used here uses 14 disks and involves more than 16,000 moves in an integer array of 3,000 elements. The **Fast Fourier Transform** test simulates a floating-point-intensive matrix operation from the world of physics.

The **Memory Allocation/Garbage Collection** test measures two characteristics of Java platforms: the speed of memory allocation and the aggressiveness of garbage-collection algorithms, which may vary from vendor to vendor. For this test, we allocate arrays of 500 elements of various Java primitive data types, as well as two AWT classes, Buttons and Panels. After each array is allocated, it goes out of scope, making it a candidate for Java's garbage collector. Although this test did not appear to invoke much garbage collection, it does point out the raw speed of allocation to begin with.

The last is the **Graphics Threads** test, which starts 16 worker threads running concurrently. Each thread draws semirandom graphics within its own AWT Panel on-screen, in an area of 100 by 100 pixels. This test hints at the differences in implementing Java threads by different vendors.

For all tests except the Graphics Threads test, higher scores are better. The unit of measurement in these tests is the number of loop iterations executed, so the figures are arbitrary on their own but directly comparable across development and runtime environments. The Graphics Threads test measures the seconds needed to perform a fixed amount of work, so a smaller score is better.

We performed all tests on a Micron 133-MHz Pentium system with 32MB of RAM, an Adaptec 2940 PCI SCSI adapter, a 2GB Conner CFP2107S SCSI drive, and an ATI Graphics Pro Turbo with a Mach64 chip and 2MB of VRAM. The system was running Windows 95. All tests were run at 800- by 600-pixel resolution with 256 colors. For all speed tests (Build Speed and Execution Speed), we ran each test three times and averaged the scores. We needed to run the Executable Size test only once.

EXECUTION SPEED

	AWT Graphics Mix	AWT Blts/Images	Vectors	Hash Table	Stack
	Score	Score	Score	Score	Score
Compiler-supplied VM	1,848 2,460 2,642	1,035 1,377 2,019	381 1,945 2,827	910 4,732 7,180	312 1,780 2,556
Netscape Navigator 2.0	2,348 2,363 2,339	749 753 759	238 234 235	561 557 563	193 193 194
Netscape Navigator 3.0	1,553 1,557 1,573	777 777 777	1,507 1,481 1,447	2,740 2,777 2,705	1,306 1,328 1,296
Microsoft Internet Explorer 3.0	2,522 2,460 2,508	1,398 1,377 1,376	1,958 1,945 1,752	4,691 4,732 4,436	1,770 1,780 1,551
	BETTER ►	BETTER ►	BETTER ►	BETTER ►	BETTER ►

What the Numbers Mean

The test results confirmed some of our expectations but also offered some surprises. For instance, we expected build times under the Java-hosted Java WorkShop to be far longer than those under other products, and indeed they were—over six times as long as under Visual J++. On the other hand, while we guessed that executable sizes would not be substantially different among products, Java WorkShop class files were consistently larger than those generated by its competitors. We occasionally saw size differences between Visual J++ and Visual Café, but in only one (GraphicsThreadingTest.class) was the difference nontrivial.

We ran the Execution Speed tests in a variety of Java VMs in order to separate performance differences attributable to compiler optimization from those attributable to VM performance, including the just-in-time compiler (JIT). We tested using Netscape Navigator, Versions 2.0 and 3.0, as well as Microsoft Internet Explorer 3.0, because nearly all the Java users in the world use one of those three environments.

We also ran the Execution Speed tests in the native VM supplied with each development environment. In other words, we ran the Java WorkShop-generated code in the VM supplied with it: the Visual Café-generated code in the Symantec-supplied VM and Visual J++ output code in the VJ++ VM (which is the same VM used by Internet Explorer). If you are interested in running Java applications as opposed to applets, these scores are relevant, since you will be running these applications in a VM outside of a browser—probably in the VM supplied with your compiler.

We did not expect to see much of a difference in the Execution

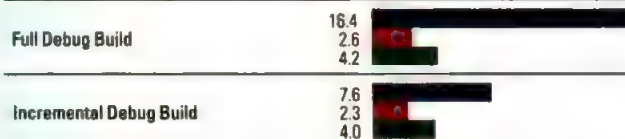
Speed tests with code running in the Netscape and Internet Explorer VMs, and in fact, there were no really large differences. All three of these products, still early in their evolution, are ultimately based on the same javac compiler from the Sun Java Development Kit, and none of the vendors appears to have gotten around to working on compiler optimization.

Under the native VMs, we saw enormous differences. The largest were between Java WorkShop and the other two products. This difference is easily explained by the absence of a JIT in the Java WorkShop VM, a factor that seems to have influenced its Build Speed scores. It's also clear from most of the other tests that since we first compared the speed of Java VMs (for details, see "Java Speed Trials," October 22, 1996), Symantec has done considerable work on its VM. It beats Visual J++ in all but the Graphics Threads Test—and sometimes by large margins. But based on the results of our Graphics Threads test, it's clear that Symantec still has some problems with thread handling.—*Analysis written by Larry Seltzer*

BUILD SPEED

- Java WorkShop
- Microsoft Visual J++
- Visual Café

Seconds

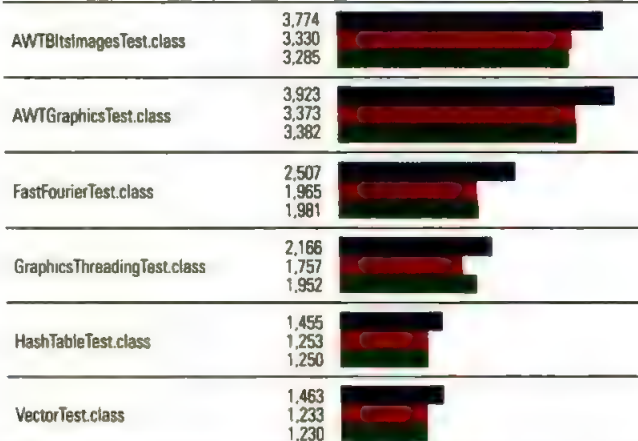


◀ BETTER

EXECUTABLE SIZE

- Java WorkShop
- Microsoft Visual J++
- Visual Café

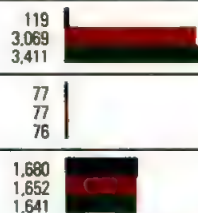
Bytes



◀ BETTER

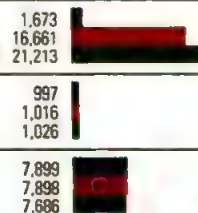
Bubble Sort

Score



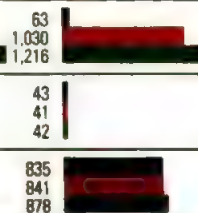
Quick Sort

Score



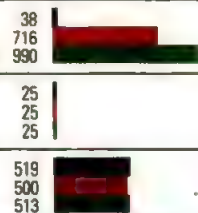
Towers of Hanoi

Score



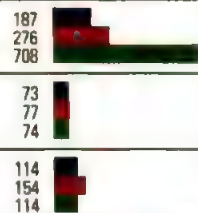
Fast Fourier Transform

Score



Memory Allocation/Garbage Collection

Score



Graphics Threads

Seconds



BETTER ▶

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Clear Process 1.0	Clear Software Inc.	1/23	46
Clearweb 1.0	Clear Software Inc.	11/19	58
ClickBook 2.0	Bookmaker Corp.	2/20	69
ClockMan95	Graphical Dynamics Inc.	11/19	60
CLR Infinity P5-166EDO	CompuLink Research Inc.	1/23	40
Color QuickCam	Connectix Corp.	9/24	60
ColorWorks 2.0	SPG Inc.	9/24	63
Colorwriter LSR 2000	Digital Equipment Corp. Printing Systems Business	8/1	63

Product name	Company name	Date	Page
CommEx 1.20	Cottonwood Software	2/20	44
Communications Suite for Windows 95, Version 7.0	Delrina Corp.	2/6	48
Compadre	Three D Graphics	3/26	66
Compaq Armada 4120T	Compaq Computer Corp.	8/1	39
Compaq Deskpro XL 6150 Model 1050/CDS	Compaq Computer Corp.	2/6	40
Compaq Presario 3020	Compaq Computer Corp.	12/3	54
Compaq Scanner Keyboard	Compaq Computer Corp.	4/23	48
Compton's Reference Collection 1996 Edition	Compton's New Media	1/9	50
CompuServe 3.0	CompuServe Inc.	12/17	54
CompuServe OurWorld	CompuServe Inc.	4/23	39
ConcertMaster	NMB Technologies Inc.	1/9	54
Connectix VideoPhone for Windows	Connectix Corp.	1/9	49
Corel CD Creator 2	Corel Corp.	5/28	69
Corel Click & Create	Corel Corp.	10/8	51
CorelFlow 3.0	Corel Corp.	3/12	44
Corel Presentations 7	Corel Corp.	9/24	69
CorelVideo	Corel Corp.	6/11	50
Corel Web Data 1.0	Corel Corp.	6/25	44
Corel Web Graphics Suite	Corel Corp.	8/1	48
Corel WordPerfect Suite 7	Corel Corp.	7/1	54
CorelXara	Corel Corp.	3/12	48
Crush	Hands-On Technology	3/12	49
CrystalLake Model 140	CrystalLake Multimedia Inc.	9/24	69
CrystalLake Model 650	CrystalLake Multimedia Inc.	9/24	69
Cyrix 6x86-P200	Crix Corp.	9/10	50
Dabbler 2.0	Fractal Design Corp.	2/6	51
DacEasy Accounting & Payroll for Windows 95	DacEasy Software	6/25	60
DataBurst ISDN 128K	U.S. Robotics Inc.	12/17	66
Day-Timer Organizer 2.0	Day-Timer Technologies	1/9	56
Day-Timer Organizer 2.1	Day-Timer Technologies	12/3	76
Decide Right 1.0	Performance Systems Inc.	1/23	63
Dell Dimension XPS P166c	Dell Computer Corp.	1/23	40
Dell Dimension XPS P200s	Dell Computer Corp.	7/1	40
Dell PowerEdge 2100	Dell Computer Corp.	11/19	48
Delphi Client/Server Suite 2.0	Borland International	4/9	39
Delphi Desktop 2.0	Borland International	4/9	39
Delphi Developer 2.0	Borland International	4/9	39
Delrina CommSuite 95	Symantec Corp., Delrina Group	3/12	56
DeltaPoint QuickSite 1.0	DeltaPoint Inc.	5/14	48
DeskMan/2	Development Technologies Inc.	2/6	63
DeskScan Color	Primax Electronics	3/12	60
Digital Celebris GL 5166	Digital Equipment Corp.	1/23	40
Director 5 for Windows	Macromedia Inc.	6/25	39
DiskMapper	Micro Logic Corp.	10/22	52
Dispatch for MCI Mail, Version 2.0	Common Sense Solutions	6/11	54
DisplayMaster	FS Photo Inc.	10/22	69
Dr. Solomon's Anti-Virus Toolkit for Windows 95	Software International Inc.	2/20	40
DocuPrint 4517mp	Xerox Corp.	4/9	60
Domino	Lotus Development Corp.	10/22	51
Drag and File Gold 2.0	Canyon Software	7/1	66
Drag and View for Windows 95	Canyon Software	1/9	46
Dragon Dictate for Windows 2.0, Classic Edition	Dragon Systems Inc.	5/14	63
Dynamite 128	Hercules Graphics	9/24	66
Easy Site	IMV Internet	10/8	57
e-Check	Peachtree Software Inc.	12/17	73
EchoSearch 1.0	Iconovex Corp.	10/22	69
E-Mail Connection 3.0	ConnectSoft	8/1	60
Emissary 1.0	The Wollongong Group Inc.	2/6	48
Epson Stylus Pro XL	Epson America Inc.	2/6	56
Eudora Pro 3.0	Qualcomm Inc.	11/19	69
Extreme 3D	Macromedia	7/1	50
EZ-SCSI 4.0	Adaptec Inc.	2/6	66

CONTINUES

A large, dark-colored Gateway 2000 Destination PC monitor is shown in a dark setting. The monitor is positioned vertically, and its screen displays the Gateway 2000 logo and the word "DESTINATION" in a stylized, glowing font. To the right of the monitor, a large, dark-colored computer mouse is visible. The mouse has a prominent circular trackball and several buttons. The overall scene is dimly lit, emphasizing the glowing text on the monitor screen.

GATEWAY 2000
DESTINATION

(Gateway's Destination Big Screen PC monitor
shown actual size)

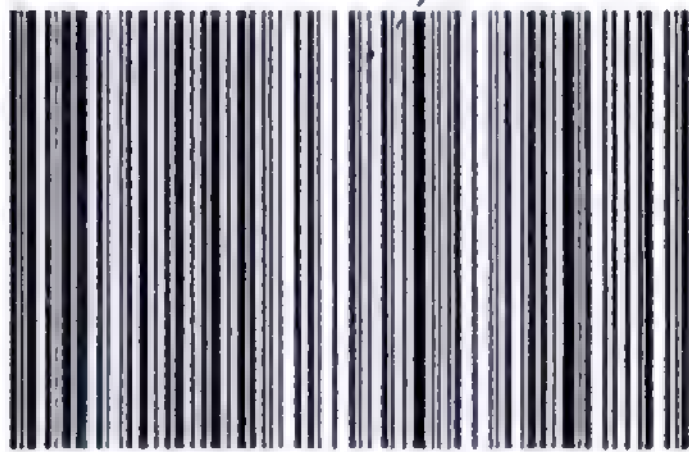
motherhood that looks great in front of a couch.

to out more about the Destination Big Screen PC and

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Back

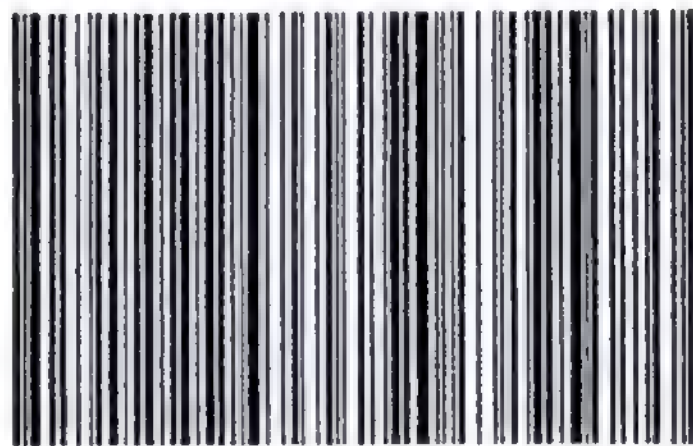
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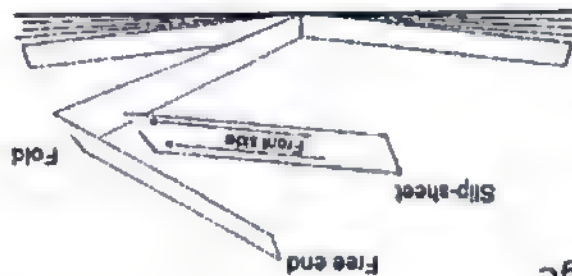
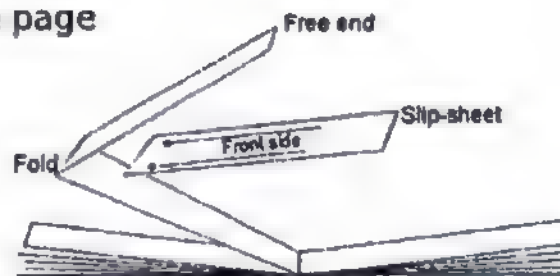
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Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



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Gateway 2000 has pioneered a whole new computer category that merges PC with TV.

We call it the Destination™ Big Screen PC, a group-computing, TV-viewing, multimedia-blasting, Internet-cruising. Or from anywhere else in the room thanks to the 31-inch monitor, wireless keyboard and Field Mouse® remote control.

It's all part of Gateway's tradition of bringing value, service and technological leadership to customers first. To find out more about our whole family of desktop and portable PCs, give us a call. We'll give you the big picture.

FIRST LOOKS (continued)

Product name	Company name	Date	Page
FileMaker Pro for Windows 95, Version 3.0	Claris Corp.	3/12	63
Final Effects AP 1.0	MetaTools Inc.	11/19	52
First Aid 95	CyberMedia	1/23	44
FloorPlan Plus 3D	IMSI	10/22	66
4th Dimension, Version 4.0	Thinking Man Software	6/25	56
Fractal Design Expression	Fractal Design Corp.	12/3	64
Fractal Poser	Fractal Design Corp.	6/25	54
FreeLoader 1.0	FreeLoader Inc.	8/1	43
Freemark Mail	Freemark Communications Inc.	9/24	44
FrontPage 1.0	Vermeer Technologies Inc.	2/20	44
Fujitsu Montego T100	Fujitsu PC Corp.	8/1	39
Fujix DS-220 Digital Camera	Fuji Photo Film U.S.A. Inc.	10/8	61
Gateway 2000 Destination D5-166	Gateway 2000 Inc.	6/11	39
Gateway 2000 G6-200	Gateway 2000 Inc.	2/6	41
Gateway 2000 P5-166	Gateway 2000 Inc.	1/23	41
Gateway 2000 P5-200XL	Gateway 2000 Inc.	7/1	40
Go Figure	Villa Crespo	1/9	56
GoldMine for Windows 95	GoldMine Software Corp.	4/9	49
GrafixStar 300	VideoLogic Inc.	1/9	42
GrafixStar 500	VideoLogic Inc.	1/9	42
GrafixStar 600	VideoLogic Inc.	9/24	66
GrafixStar 700	VideoLogic Inc.	1/9	42
GreenForm 1.6	GreenSoft Corp.	8/1	63
Harvard ChartXL 2.0 for Windows	Software Publishing Corp.	1/9	48
HiJaak Pro 4.0	Quarterdeck Corp.	11/5	48
Hitachi C120	Hitachi Corp.	8/1	39
HoTMail	HoTMail	9/24	44
HP Color LaserJet 5M	Hewlett-Packard Co.	3/26	40
HP DesignJet 755CM	Hewlett-Packard Co.	6/25	51
HP DeskJet 340	Hewlett-Packard Co.	2/20	51
HP LaserJet 5M	Hewlett-Packard Co.	5/28	63
HP LaserJet 5Si Mopier	Hewlett-Packard Co.	12/17	60
HP OmniGo 100 and Connectivity Pack	Hewlett-Packard Co.	2/6	54
HP Pavilion 7130P	Hewlett-Packard Co.	6/11	41
HP Pavilion 7295V	Hewlett-Packard Co.	10/22	39
HP ScanJet 4p	Hewlett-Packard Co.	3/26	60
HP ScanJet 4s	Hewlett-Packard Co.	1/9	37
HP Vectra XU 6/200C	Hewlett-Packard Co.	2/6	41
Hurricane 2.0	Helix Software	10/8	48
I-Bahn	Angia Data Communications	12/3	65
IBM Aptiva C66 with Home Director	IBM Corp., Consumer Division	10/8	51
IBM Aptiva S74	IBM Personal Computer Co.	10/22	39
IBM PC350	IBM Personal Computer Co.	7/1	40
IBM 350	IBM Personal Computer Co.	1/23	41
IBM VoiceType 3.0 for Windows 95	IBM Worldwide Speech Systems	10/8	62
IDC 100i	Cardinal Technologies	10/8	39
Imaging for Windows 95, Version 1.0	Microsoft Corp.	5/14	60
Imaging for Windows 95, Version 1.0	Wang Laboratories	5/14	60
Impos/2	Compart	12/17	73
Impulse A2	Appian Graphics	5/14	54
InContext Spider Version 1.1	InContext Systems	5/14	48
Incredible Sound	Phillips Key Module	3/26	63
IncreMeg Full Profile Docking Station	MountainGate Data Systems Inc.	2/20	56
IncreMeg 2.0GB drive cartridge	MountainGate Data Systems Inc.	2/20	56
IncreMeg 4.1GB drive cartridge	MountainGate Data Systems Inc.	2/20	56
Indeo Video Interactive	Intel Video Technology	1/9	37
InfoModeler 2.0	Asymetrix Corp.	10/22	60
Informer 1.5	Reportech Inc.	2/20	54
Info Select for Windows 3.0	Micro Logic	1/9	40
InterGO	InterGO Communications Inc.	4/23	69
Internet Marauder 1.4	Bourbon Street Software	8/1	44
InternetSuite for Windows 1.0	Quarterdeck Corp.	2/6	48
Intranet Genie 1.1	Frontier Technologies Corp.	11/5	63
Iomega Jaz Drive	Iomega Corp.	4/9	44
IrisPen Executive	Image Recognition Integrated Systems	6/11	63
ISYS HindSite	ISYS/Odyssey Development	11/5	48
Jammer Professional	Soundtrek	6/11	56
Janna Contact Personal	Janna Systems Inc.	11/19	69
Java Development Kit 1.0	Sun Microsystems	4/9	51
JetEye Net Plus	Extended Systems	7/1	48

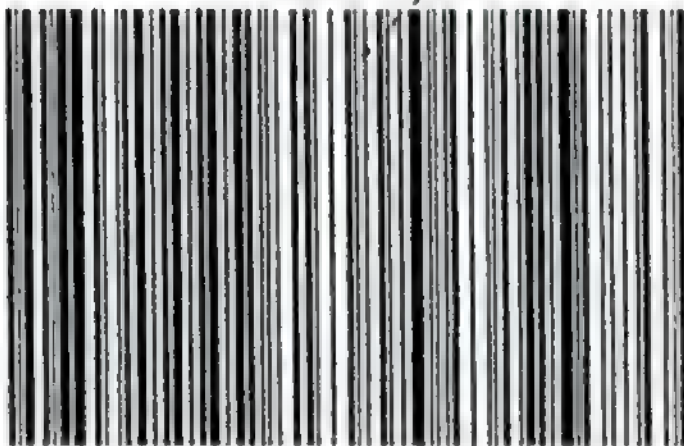
Product name	Company name	Date	Page
Juno	Juno Online Services LP	9/24	44
Kai's Power Tools 3	MetaTools Inc.	5/14	39
Kodak DC-20	Eastman Kodak Co.	9/10	60
Kodak DC-50	Eastman Kodak Co.	3/12	39
Kodak Photo Insert Software	Kodak Digital Science	1/9	51
Kurzweil Voice Release 2.0	Kurzweil Applied Intelligence Inc.	8/1	58
Labtec Imager	Labtec	3/26	63
LapLink for Windows 95	Traveling Software	3/26	48
LightSpeed 128	STB Systems	9/24	66
LitePro 620	In Focus Inc.	10/8	56
Logitech PageScan Color	Logitech Inc.	1/23	43
Lotus Notes Release 4	Lotus Development Corp.	3/12	39
MacOpener 1.0	DataViz	1/23	46
MacOpener 2.0	DataViz	9/10	60
Macsyma 2.1	Macsyma Inc.	8/1	66
Magic Artist Stretch Canvas	Rexam Graphics	6/25	48
Maple V, Release 4	Waterloo Maple Inc.	10/8	66
Maxi Sound	MaxiSwitch Inc.	1/9	54
Maxmedia TV/Pro II	Umax Technologies	6/11	51
McAfee Personal Vault	McAfee Associates Inc.	10/8	50
McGraw-Hill's Financial Analyst	McGraw-Hill Inc.	4/23	48
MediaAgent for CDs, Version 1.0	MediaPath Technologies Inc.	11/19	51
Media Express MPEG card	Apex Data	11/19	58
Media Paint 1.0	Strata Inc.	9/10	48
Meeting Maker XP 3.1 for OS/2	ON Technology Corp.	3/12	51
Megahertz AllPoints Wireless PC Card	U.S. Robotics Mobile Communications Corp.	5/28	66
MicroFlex-686/100	Micro Express	3/12	54
Micron Millennia P200	Micron Electronics Inc.	7/1	41
Micron Millennia TransPort P133	Micron Electronics Inc.	4/9	39
Micron P166 Millennia Plus	Micron Electronics Inc.	1/23	41
Micron Pro 200 Magnum Plus	Micron Electronics Inc.	2/6	42
Microsoft Exchange Server 4.0	Microsoft Corp.	6/11	48
Microsoft FrontPage 1.1	Microsoft Corp.	11/19	39
Microsoft IntelliMouse	Microsoft Corp.	12/17	65
Microsoft Internet Explorer 2.0	Microsoft Corp.	2/20	54
Microsoft Internet Explorer 3.0	Microsoft Corp.	5/28	40
Microsoft Internet Explorer 3.0	Microsoft Corp.	9/10	39
Microsoft Internet Information Server, Version 1.0	Microsoft Corp.	5/28	41
Microsoft Small Business Financial Manager	Microsoft Corp.	10/22	66
Microsoft Visual C++ 4.0, Subscription Edition	Microsoft Corp.	3/12	66
Microsoft Windows NT Workstation 4.0	Microsoft Corp.	11/5	44
Minolta RD-175	Minolta Corp.	5/14	39
Mirage D16-L	Umax Data Systems Inc.	4/9	48
miroVideo DC30	miro Computer Products Inc.	11/5	52
Mitsumi VB-501 PCTV	Mitsumi Electronics Corp.	11/5	51
Modula Executive Desk Pad	Source Innovations Inc.	8/1	58
MPEG Player for VMC	VideoLogic Inc.	1/9	42
MultiActive Maximizer 3.0is for Windows 95	Maximizer Technologies	7/1	66
Multimedia MM100	Scala USA Inc.	9/24	63
Navigator Atlas	Netscape Communications Corp.	5/28	40
NEC MultiSpin 4x4	NEC Technologies Inc.	2/20	56
NEC MultiSync LCD200	NEC Technologies Inc.	3/26	69
NEC MultiSync M500	NEC Technologies Inc.	5/14	44
NEC MultiSync P1150	NEC Technologies Inc.	12/17	64
NetObjects Fusion	NetObjects Inc.	11/19	39
Netscape FastTrack Server	Netscape Communications Corp.	5/28	41
Netscape Navigator 2.0	Netscape Communications Corp.	2/6	48
Netscape Navigator 3.0	Netscape Communications Corp.	9/10	39
Netscape Navigator Gold 2.0	Netscape Communications Corp.	6/11	44
Netscape Navigator Gold 3.0	Netscape Communications	11/19	39
NetServer LX Pro	Hewlett-Packard Co.	9/10	42
Net2Phone	IDT Corp.	10/22	58
NetTV WorldVision 2900	NetTV Inc.	6/11	40
Neural Connection 1.0	SPSS Inc.	3/26	51
Nikon ScanTouch 110	Nikon Inc.	12/3	70
Nokia Multigraph 447Xav	Nokia Display Products Inc.	6/25	56
Norton AntiVirus for Windows 95	Symantec Corp.	2/20	40
Norton AntiVirus 2.0 for Windows 95	Symantec Corp.	12/17	52
Norton pcAnywhere 32 for Windows	Symantec Corp.	3/26	48

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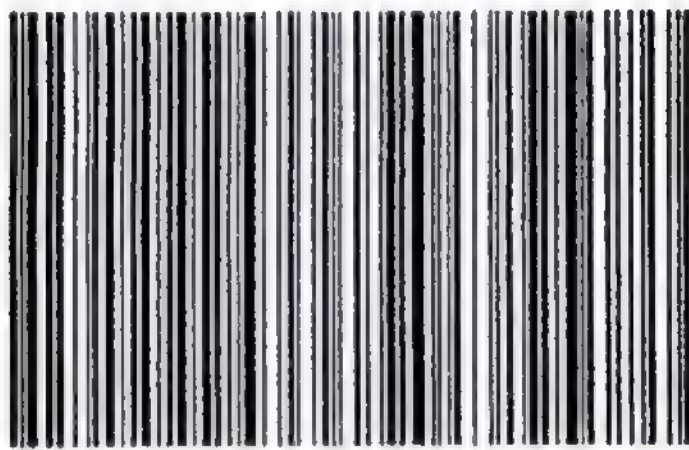
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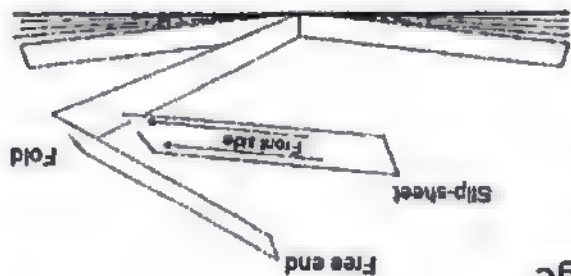
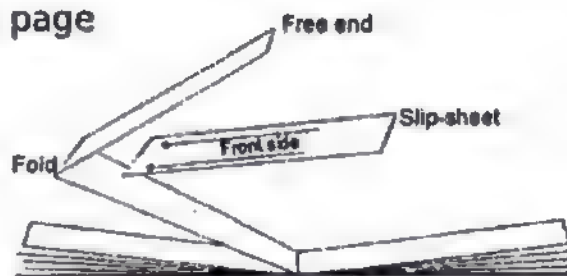
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Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



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4. Close the page and slip-sheet

Foldout slip-sheet

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Product name	Company name	Date	Page
Norton Your Eyes Only	Symantec Corp.	12/17	45
Object Desktop	Stardock Systems	2/6	63
OmniPage Pro for Windows 95, Version 7.0	Caere Corp.	9/24	43
OmniPost Analyzer	Omni Diagnostics Inc.	6/25	66
150-MHz Pentium OverDrive Processor	Intel Corp.	3/26	54
One-Write Plus Version 5.0 for Windows	NEBS Software	3/26	45
Ornamatica	JASC Inc.	12/17	76
Painter 4	Fractal Design Corp.	3/26	45
Paint Shop Pro 3.12	JASC Inc.	2/6	51
Panasonic CF-62	Panasonic Personal Computer Systems	11/19	63
Panasonic CF-VEV411 Full-Motion Video Pack	Panasonic Computer Co.	1/9	42
Panasonic KXL-D20 Multimedia Sound Kit	Panasonic Communications and Systems Co.	1/9	44
Panasonic KXL-D721/KXL-D720 PCMCIA CD-ROM Player	Panasonic Communications and Systems Co.	1/9	44
Panasonic PanaSync Pro P21	Panasonic Computer Peripheral Co.	12/17	64
PaperEASE	Primax Electronics	4/23	51
PaperMaster 2.0	DocuMagix Inc.	6/25	66
PaperPort Vx	Visioneer Inc.	1/9	37
Paradox 7 for Windows 95 and Windows NT	Borland International Inc.	2/6	39
Partition Magic	PowerQuest Corp.	3/26	56
PC-cillin 95, Version 1.0	TouchStone Software Corp.	2/20	40
PC411 for Windows 1.1	PC411 Inc.	3/26	51
PerfectWorks 3	Novell Inc.	4/23	66
PGP for Windows, Business Edition	Pretty Good Privacy Inc.	12/17	45
Philips PCA20TV	Philips Professional Solutions	11/5	51
PhotoGraphics	TrueSpectra Inc.	12/17	73
PhotoPC	Epson America Inc.	5/14	40
Pilot 5000	U.S. Robotics	5/14	42
PlanMaker 2	PowerSolutions for Business	2/20	66
PointCast Network	PointCast Inc.	7/1	60
Polaroid PDC-2000/40	Polaroid Corp.	7/1	56
Poly P200Cx	Polywell Computers Inc.	9/10	51
PosterWorks 4.0 for Windows	S. H. Pierce & Co.	6/25	51
PowerDesk	MicroHelp Inc.	2/20	66
PowerLib-Math, Version 1	Winsoft Corp.	5/14	56
PowerShot 600	Canon Computer Systems Inc.	8/1	52
PowerSync 3.0	LinkPro Technologies Inc.	10/22	52
Print House for Windows 95	Corel Corp.	2/20	63
Prodigy Personal Web Pages	Prodigy Services Co.	4/23	39
Project KickStart for Windows	Experience In Software Inc.	2/6	60
Prospero 1.0	Oberon Software	5/14	56
PSA Cards 2.61	PSA Software	2/20	51
Publishing Essentials	Tumbleweed Software	5/14	66
Puffer 2.0	Kent Briggs	5/14	46
QEMM 8.0	Quarterdeck Corp.	2/6	66
Qualitas MAX 8	Qualitas Inc.	3/12	51
QualiType Super Value Bundle	QualiType Software	11/5	63
QuickBooks Pro 4.0 for Windows	Intuit Inc.	6/11	54
RealAudio Version 2.0	Progressive Networks	8/1	51
REALmagic Ultra	Sigma Dimensions Inc.	9/24	51
Recollect Gold	MindWorks Corp.	3/12	49
Remove-It, Version 3.0 for Windows 95	Vertisoft Systems Inc.	4/23	54
Revolution Quad6	Advanced Logic Research Inc.	9/10	42
Road Trips Door-to-Door	TravRoute Software	11/5	39
RTE-3000A Advanced Real-Time MPEG-1 Encoder	Sony Electronics Inc.	4/23	63
SafeSend	Angia Corp.	4/9	41
ScanAce III	Pacific Image Electronics Co.	12/17	76
Sceptre CD-1112T LCD	Sceptre Technologies Inc.	6/11	63
Schedule It!	Outlook Software Corp.	2/6	60
Scrambler for Windows	Scrambler Technologies	1/9	50
Secret Agent	AT&T Business Communications Services	12/17	45

Product name	Company name	Date	Page
SecurPC for Windows 95	RSA Data Security Inc.	12/17	45
Seven Habits Tools	Covey Leadership Center	8/1	66
Sharp ZR-5800FX Keyboard Enhanced Personal Digital Assistant	Sharp Electronics Corp.	7/1	48
SmartBoard, Version 1.0	Insight Software Solutions Inc.	6/25	63
SmartBookmarks 2.0	FirstFloor	8/1	44
SmartDraw Pro Version 2.02	SmartDraw Software	1/23	44
SmartSound for Multimedia	Sonic Desktop Software	9/10	66
SmartSuite 96 for Windows 95	Lotus Development Corp.	2/20	48
SnagIt Twin Pack	TechSmith Corp.	9/24	52
SolidWorks 95	SolidWorks Corp.	6/11	60
Sony DVBK-1000	Sony Electronics Inc.	12/17	66
Sony PCV-90	Sony Electronics Inc.	10/22	39
Sportster 33.6 Faxmodem	U.S. Robotics	12/3	45
SPSS Version 7.0	SPSS	4/9	66
StatView, Version 4.5	Abacus Concepts	10/22	60
StreetSmart Pro	Charles Schwab & Co.	11/19	60
Submit THIS! 1.0	Microrim Inc.	9/24	58
SuperCoolscan LS-1000/SF-100 Auto Slide Feeder	Nikon Electronic Imaging	1/9	51
SuperPrint 4.0	Zenographics	3/26	56
Supra NetCommander ISDN	Diamond Multimedia Systems Inc.	10/8	43
Surefind	Surefind Information Inc.	10/8	50
SureTrak Project Manager for Windows 1.5	Primavera Systems Inc.	1/9	48
Survey Pro for Windows 2.0	Apian Software	11/19	66
SurveyWin 3.01	RaoSoft Inc.	11/19	66
Symantec Café 1.0	Symantec Corp.	6/11	39
Sys Performance C166+	Sys Technology Inc.	4/23	44
Sys Performance C200+	Sys Technology Inc.	9/10	51
Sys Performance P200T2	Sys Technology Inc.	7/1	42
Tally T7070	Mannesmann Tally Corp.	10/22	63
Tapedisk Professional for Windows 95, Version 6.5.2	Tapedisk Corp.	5/14	60
Tektronix Phaser 550	Tektronix Inc.	4/9	56
10Xtreme	Pinnacle Micro Inc.	9/10	63
TextBridge Pro 96	Xerox Desktop Document Systems	9/24	43
3-D/EYE Trispectives 1.0	Trispectives	1/23	60
3D Studio Max	Kinetix, a division of Autodesk Inc.	7/1	50
ThunderByte Anti-Virus Utilities Professional Version for Windows 95	TCT ThunderByte International Corp.	2/20	41
Tim Berry's Business Plan Pro	Palo Alto Software Inc.	6/25	63
Toshiba Infinia 7200	Toshiba America Information Systems Inc.	10/22	39
Toshiba Portégé 650CT	Toshiba America Information Systems Inc.	8/1	39
Toshiba Tecra 720CDT	Toshiba America Information Systems Inc.	6/25	39
TranXit Pro	Puma Technology Inc.	6/11	44
TripMaker 1997 Edition	Rand McNally New Media	11/5	39
TrueMotion-S Compressor	Horizons Technology Inc.	1/9	38
TVideo	Logiccode Technology	11/5	66
Ulead PhotoImpact 3.0	Ulead Systems Inc.	4/23	56
UniMaint	SoftTouch Systems Inc.	2/6	63
UnInstaller 3 for Windows 95	MicroHelp Inc.	4/23	54
ViewSonic P815	ViewSonic Corp.	12/17	64
VirusScan for Windows 95	McAfee Associates Inc.	2/20	41
VirusScan 2.0 for Windows 95	McAfee Associates Inc.	12/17	52
Visual Reality 2.0	Visual Software	1/23	60
VisualX for ActiveX 1.0	InterGroup Technologies Inc.	12/17	70
Vivid3D Proxx	NuReality	3/26	63
VMC Controller	VideoLogic Inc.	1/9	42
WakeBoard Multimedia Pro	Digital Video Arts Ltd.	11/5	58
WebAnalyzer	InContext Systems	6/25	44
Web Buddy 1.0	DataViz	12/17	70
WebEx	Traveling Software	8/1	44
WebMax	Berkeley Systems	9/10	58
WebSeeker 2.0	The ForeFront Group	12/3	66
WebSuite Starter Edition	DigitalStyle Corp.	7/1	60
WebWhacker 2.0	ForeFront Group	8/1	44

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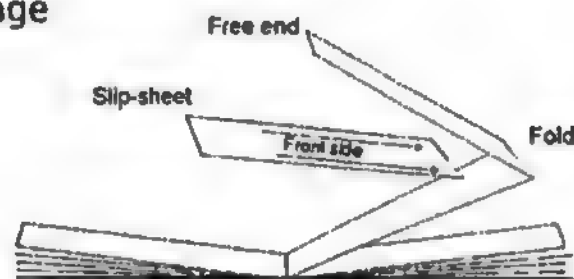
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ged the way you look at computers.



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www.gw2k/destination.com

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

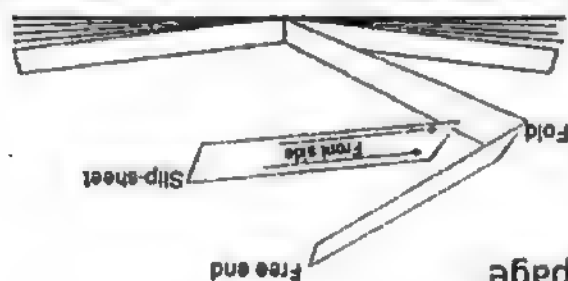


Foldout slip-sheet



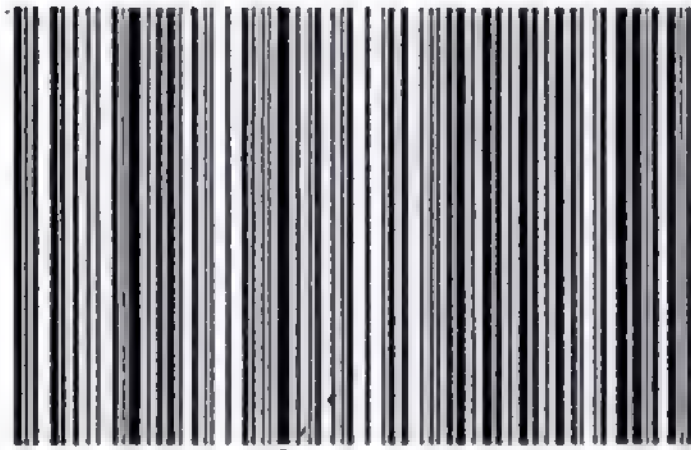
Inverted foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



Gbs511pBack-0018

Back

1. Follow instructions on the other side

The Destination
We've changed
Again.



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ENDS

Open JBuilder: Java RAD with a Data Focus

By Kaare Christian

Borland's forthcoming Open JBuilder development system for Java (code-named Latte) is a hybrid that combines the company's traditional strength in development tools with its long-standing focus on database connectivity. The combination will be appropriate for a wide range of developers but will appeal particularly to corporate development teams building complex client/server applications.

We looked at a pre-beta version of Open JBuilder. A public beta is expected to be available on Borland's Web site by the time you read this, and the full release is expected during the first quarter of 1997. For updates, see www.borland.com.

DELPHI-LIKE RAD

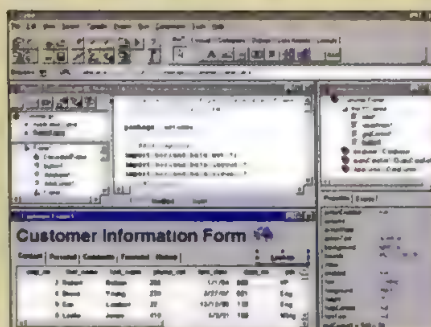
Open JBuilder is designed to be a high-productivity RAD environment. Borland has given the environment a close resemblance to Delphi, its Object Pascal-based visual programming environment, but with a simpler, subtler flavor we came to appreciate. You can drag components from a palette onto a form, access components' properties using an inspector, and manage interactions among components by writing event-handling functions.

All of the components on the Open JBuilder palette will be JavaBeans, based on Sun's recently published JavaBeans specification. Consistent use of JavaBeans as the component model, although a forward-thinking move, is one of the reasons Open JBuilder was not shipping as early as some other Java products.

Like Delphi, Open JBuilder uses two-way tools. Modifications made graphically to the appearance of a form are instantly reflected in the source code managing that form, and changes to the code instantly alter the form's appearance.

The heart of the Open JBuilder programming environment is the

three-pane project window, which loosely follows the hyperlinks navigation metaphor used by Web browsers. The chief difference is that where hyperlinks are embedded inside a Web browser's content, the hyperlinks in an Open JBuilder project are the elements of an outline shown in the Navigator pane, the top-left pane of the project window. Open JBuilder maintains links automatically, whereas links in Web documents must be placed explicitly in the document. Like a browser, Open JBuilder has a Home



Open JBuilder's three-pane project window is shown below the menu bar, with a component inspector to the right.

button, which in Open JBuilder takes you to the project's top level, plus a Forward button to follow a link and a Back button to reverse your course.

Below the Navigator pane is the Structure pane, which shows the details of a selected item. For a source-code window, for example, the Structure pane lists procedures and variables. For a form, the Structure pane lists the form's components. To the right of the Navigator and Structure panes is the Contents pane, which displays whatever you've selected in the Navigator and Structure panes. If you've selected a source-code file, the Contents pane will use a programmer's editor to display it; if you've selected a bitmap resource, the pane will use a bitmap editor, and so on.

This unified multipane interface is much simpler than the deluge of windows in many older programming

products. There is an integrity and a clarity in Borland's approach that we haven't seen elsewhere, although the general trend of simpler, leaner user interfaces is present in all the products we've looked at.

One of the most interesting aspects of Open JBuilder's project window is its extensibility. Borland has created a standard programming interface that allows other content editors to be plugged into the Open JBuilder environment and to take charge of the project window when the appropriate content is selected. For example, if you purchase a third-party source code control system, you'll be able to access it by clicking on the source code control object in your project. This well-conceived extensibility standard may create a third-party aftermarket for Open JBuilder plug-ins.

Open JBuilder includes a raft of database-oriented facilities, and its new Data Director architecture facilitates using Java for scalable client/server applications. Data Director incorporates JDBC drivers, so you can access a variety of data stores, including SQL databases. In addition, there are JDBC drivers for two existing data-access standards, ODBC and Borland's BDE. For data-centered applications, Borland clearly is trying to make the Java environment as productive as the time-tested Delphi environment.

Another data-related aspect of Open JBuilder is Borland's inclusion of Entera technology. Entera lets applications on a workstation execute code that resides on a server and helps desktop applications access remote data.

Borland has always understood developers' needs, and Open JBuilder indicates that the company hasn't lost its touch. If you're interested in both data and Java, Open JBuilder warrants your attention. If you're interested in building Web sites or creating multiplatform applications with Java, then Open JBuilder is worth evaluating.

controls. It takes a few minutes to master, but we found it an adequate design tool. With the default AWT tools, placement of controls is less precise than you would get with development systems that provide a Windows-style, screen-independent layout manager. But using them gives you a good sense of what will actually appear in real-world Web pages.

The Visual Java tool also includes support for generating default event handlers for common AWT classes, such as Button and Choice controls. You can also change attributes or perform simple operations like calling a procedure without writing the code yourself. Once you're satisfied with the layout of your design, you generate the actual Java code. Unfortunately, Visual Java is a one-way tool. It will not reflect any changes you've made to your code, and it will overwrite any changes you've made when it regenerates code. So you'll still need to write your own code in Java WorkShop, as the wizards will get you only so far. Though you cannot edit an image inside Java WorkShop, you can add images to Java components easily, using a custom image control.

You perform traditional source-code editing with the Source Editor window. Surprisingly, the current release does not provide syntax highlighting of Java or HTML code, and limitations in AWT also prevent you from printing your source files. Both features are planned for future releases. Java WorkShop does support automatic insertion of default HTML parameters needed for your Java applets. To help with team projects, it also includes built-in support for Inter-solv's PVCS and, for Unix users, MVS source-code control.

One of Java WorkShop's strongest tools is its highly graphical Source Browser class-browsing tool, which generates clear descriptions of any Java class, including custom classes. Members and methods are fully documented. Although there is currently no way to print the tool's output, Source Browser deliv-

ers useful instant documentation about your classes.

HOTJAVA DEBUGGING

The Java WorkShop debugger is a truly integrated tool, since it works within the browser-like development host environment. WorkShop relies on javac, the standard Sun JDK compiler, for building projects. Although the Sun compiler proved noticeably slower than the others in this roundup, the integrated development tools and debugger provided a very fast edit, build, and debug cycle. You have excellent control of watchpoints and breakpoints and multithread debugging capability, including full access to system threads. All the standard Java exception classes are listed, and you can define whether to break or ignore individual exceptions. The debugger poses a good test of how well a traditional interface with many open windows can work in HTML. We occasionally found it difficult to locate the right window (again, a layering problem), but generally the interface worked quite well.

The help system in Java WorkShop uses HTML text to good effect to deliver information on the development environment and on standard Java class APIs. Unfortunately, there is currently no search facility. The online tutorial is particularly rigorous and includes a step-by-step guide to familiarize you with the Java WorkShop environment.

Overall, Java WorkShop is an intriguing tool that takes good advantage of its fundamental Java and Internet orientation. More than just an impressive proof of concept for Java applications—although it is certainly that—Java WorkShop deserves a look as a new and productive route to Java development.

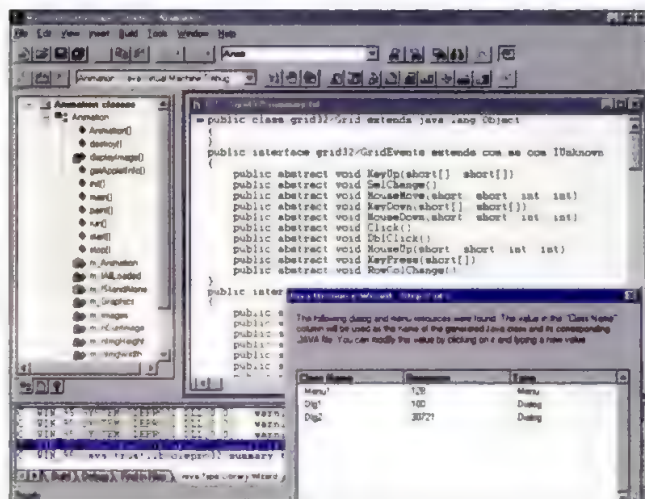
Java WorkShop 1.0. List price: \$295. Sun Microsystems, Mountain View, CA; 800-786-7638; www.sun.com/developer-products. Circle 490 on reader service card.

Microsoft Corp.

Microsoft Visual J++, Professional Edition

Microsoft Visual J++ 1.0 Professional Edition, the company's first offering in the Java tool market, is a strong first release that stresses a traditional 3GL development paradigm, ActiveX support, and solid compiler technology. Visual J++ builds on the strengths of Microsoft Visual C++ to give Java developers many of the features C++ programmers have come to expect, plus new functionality designed specifically for Java. Like Visual C++, however, Visual J++ is not particularly visual: It does not enable RAD-style layout or seamless access to component properties, methods, or events.

The development environment in Visual J++, the highly customizable Microsoft Developer Studio, will be familiar to



Visual J++ supports ActiveX through the Java Type Library Wizard and lets you import Windows resources with the Resource Wizard.

any Visual C++ user. Your command center is the Project Workspace window, which includes tabs to manage classes, source files, and online help. You can begin your project using the Java AppWizard tool, which helps you build a default Java applet or application. Here, Visual J++ provides several advantages. You can create standalone and applet versions of your project using the same code; just set a flag and your code will compile as either one. The Java AppWizard also lets you generate multithreaded animations with sample .GIF files, which can be easily customized. Since many Java

SUITABILITY TO TASK

Java WorkShop

	Power	Ease
User interface design	Good	Good
Rapid applications development	Good	Good
Debugging	Excellent	Good

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commitment
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VisualAge for Java: Addressing the Enterprise

By Kaare Christian

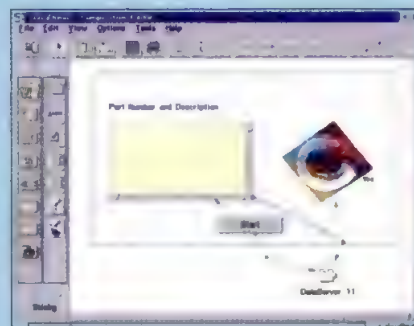
Where other vendors see Java as a means to build turbocharged Web pages, IBM sees it as a solution for an age-old problem: linking back-end data centers to the users of the data. We looked at an early version of VisualAge for Java, but the broad outline of IBM's approach—which includes JavaBeans generation from existing database schemas, proxy building, and the ability to invoke CICS transactions remotely—is clear. VisualAge for Java should be in beta about the time this story appears (for updates, see www.software.ibm.com).

Because of the breadth of IBM's vision, VisualAge is far more than a visual Java programming environment. It also offers a collection of tools for automating connections to remote data; middleware technology that handles much of the communication; software that integrates Java with other key technologies, such as OpenDoc, CORBA, and JavaBeans; and drivers to enable Java access to virtually any database.

VisualAge's Java development environment is an implementation of the VisualAge construction-from-parts approach already used in other IBM language products, including VisualAge for C++ and VisualAge for Basic. The debugger in VisualAge for Java supports the usual features, such as breakpoints and live code examination features. More radical is its support for adding or changing procedures while an application is running—a feature that doesn't matter much if you're

working on a small application with a short edit/compile/debug cycle, but a very important one if you're working on large projects, which are much slower to restart. (Updating code in a live application is also supported, and perhaps more fully developed, in Asymetrix's upcoming SuperCede Java environment.)

A Java development environment, while important, is only a small part of IBM's offering. If you want to access legacy data from the desktop, there are



VisualAge for Java's construction-from-parts interface makes program flow visible.

several issues to confront, including *communication*, or how Java transmits a data request from the desktop to the back end, and *access*, or how Java interacts with a specific database.

Communication is addressed in several ways: by software that lets Java work with existing middleware software protocols, including CICS, and by Proxy Builder, a tool that helps a developer set up communication paths between a desktop machine and a data server and partition the application workload, thus offloading the task

from the Web server.

Access is also addressed in several ways. First, IBM is hewing closely to the JDBC standards for connecting Java to native databases. The company is developing JDBC drivers for its own databases, and they will be available over the next few months. In addition, IBM is encouraging other database vendors; Oracle and Sybase have already committed to creating JDBC drivers for their products.

Access is also addressed by VisualAge's Data Access Builder, which can read the schema of a remote database and then create a JavaBean that corresponds to it, giving your application access to that data. Once you have the JavaBean data-access encapsulation, you can use Visual Builder to drag it onto a form. Visual Builder lets you create applications graphically by creating connections between JavaBeans. Once the basic connections have been diagrammed, you can then use the JavaBean's methods to interact with the host database. Visual Builder is something like the Interaction Wizard in Symantec's Visual Café but more systematic.

IBM is putting an enormous amount of work into making it easy to create a desktop Java application that has a secure, fully functional connection to remote data. VisualAge for Java isn't necessarily the ticket for writing Web page animations, but it holds great promise for large corporations that envision Java as the link between back-end data and heterogeneous desktop stations.

components rely on animation, this is an especially useful feature.

Another option lets you specify which parameters will be passed from your HTML file as part of its <APPLET> tag. Visual J++ will automatically declare member variables that contain these settings. As in the other products reviewed here, the code wizard will generate a default HTML page for your browser.

Once you generate a default project,

the ClassView tool lets you manage it as a group of browsable classes. As you enter your own code, ClassView works behind the scenes to provide an update of all classes. You can add new members and methods using a dialog box and quickly access any member or method in your code. While ClassView is a useful tool, it will not show how groups of classes inherit from one another, a view that can be useful. Clicking on any item in the ClassView win-

dow points you right to the source code.

The FileView tool provides a view of your project in traditional source files. Either way, as you edit source code you'll appreciate the basic editing functionality, including Brief and Epsilon emulation, customizable syntax highlighting for Java and HTML files, and keystroke recording.

When you come to building a user interface, Visual J++ offers standard resource editors for menus, forms, and graphics files.

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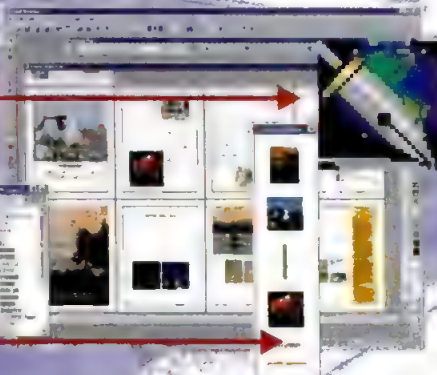
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SUITABILITY TO TASK

Microsoft Visual J++

	Power	Ease
User interface design	Good	Good
Rapid applications development	Good	Good
Debugging	Excellent	Excellent

It is unique among the products reviewed here in that you can view and edit .GIF and JPEG files in addition to .BMP files. Once you save these visual elements in a .RES file or resource template file (.RCT), you run the Resource Wizard to convert them into corresponding Java files. To save time, you can also import a Windows resource script file into a Java project.

Because there is no support for resources in Java, Visual C++ users will notice that the familiar ResourceView tab is missing in their Java projects. You can edit the usual resource types, but you'll have to convert them into Java code using the Resource Wizard. We found this approach less than ideal. Currently, Visual J++ has no support for adding events to individual visual components, although we expect to see such support in future re-

leases. Because the Java code is rewritten each time the Resource Wizard runs, you can't preserve changes to Java code when the visual design changes. On the plus side, the Resource Wizard provides a special AWT layout manager that simulates the screen-independent dialog coordinates familiar to Windows programmers.

Actually building a project in Visual J++ proved quite fast, and you can build with or without debugging options. Debugging support in Visual J++ is strong: You have full control over watchpoints and breakpoints, and there is an excellent tabbed interface for viewing watches, automatic variables, and threads. Visual J++ also provides the ability to disassemble Java bytecodes. Like Visual C++, Visual J++ makes use of DataTips, which let you inspect the value of any variable by holding the cursor over it. You can also view variables by dragging them to watch windows. You can specify how the debugger will handle any Java or custom exception. In addition to a basic applet viewer, Visual J++ includes Microsoft Internet Explorer 3.0 and supports its debugging

hooks, letting you debug multiple applets running on the same HTML page.

ACTIVEX: USE AND BUILD

One uncontested strength of Visual J++ is its unparalleled support of ActiveX components. The Java Type Wizard tool generates a Java wrapper class for any ActiveX/COM object, which can be manipulated from within your classes. The syntax is remarkably elegant, since Java takes care of many of the nuts and bolts of working with COM. Excellent documentation and sample code suggest ways to take advantage of ActiveX/COM objects within your Java projects, including accessing databases through RDO or DAO.

You can build reusable ActiveX components from within Visual J++, although this obviously requires a more in-depth knowledge of ActiveX. Visual J++ shows not only that Java and ActiveX can coexist peacefully, but also that Java offers some real advantages in working with ActiveX, including a simpler syntax for getting to COM objects. Microsoft says it plans to add ActiveX/JavaBeans interoperability

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but has not indicated that it will support JavaBeans as a native component type.

Overall, this is a strong first release, with all the support and features you need to start writing and debugging Java projects. If you are a Visual C++ programmer or prefer a traditional 3GL approach to development, Visual J++ deserves consideration as a serious Java development tool. **Microsoft Visual J++ 1.0, Professional Edition.** List price: \$99. Microsoft Corp., Redmond, WA; 800-621-7930; www.microsoft.com/visualj. Circle 491 on reader service card.

Symantec Corp.

Visual Café



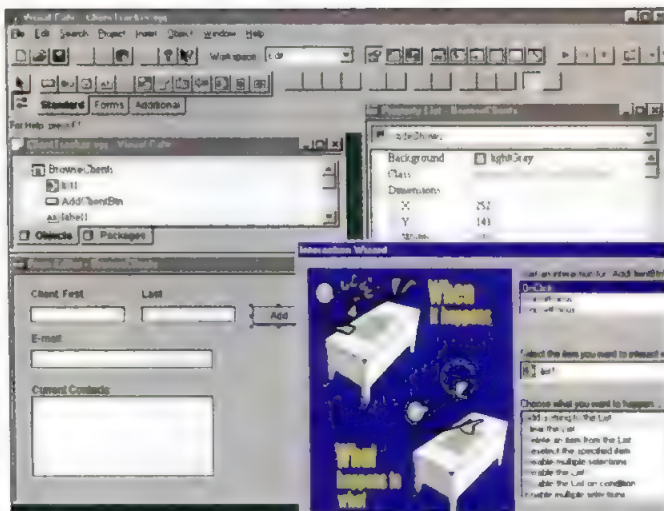
Symantec Corp.'s Visual Café 1.0 is the only second-generation Java tool in this roundup, and its maturity shows. Although it will coexist with, rather than replace, the company's earlier Symantec Café, it incorporates much of Café's established core technology. Visual Café combines the strength of a traditional compiler with a

more advanced RAD-style, component-based programming model. The forward-looking paradigm clearly positions Visual Café as a trendsetter for the future of Java development.

We looked at Visual Café in a late beta version that was freely available on the Web. Although several minor features had not been fully implemented, it was generally stable and bug-free, and we would not hesitate to recommend it for real-world projects. The final release is expected before this article appears.

The Visual Café interface offers several of the same tools as Symantec Café 1.5 and extends them with new wizards and features specific to component-based

programming. When you define a new project, you are offered the choice of generating a default applet or standalone application. The project window is divided into two tabs: Objects, for viewing a project as a group of classes, and Packages, for accessing your project as a collection of files. For



Visual Café's Interaction Wizard lets you edit properties and events or program simple events without coding.

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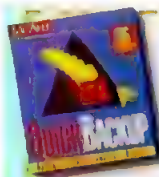
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SuperCede: Java for Desktop Applications

By Kaare Christian

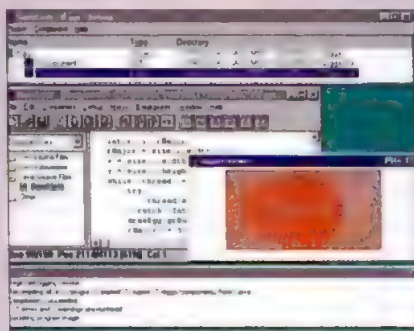
Asymetrix Corp. has long been known for easy-to-use tools such as ToolBook, but SuperCede is the company's first entry in the power-tools arena. SuperCede is a dual Java/C++ development environment that delivers a trio of intriguing and technically over-the-top features. You should be especially interested in SuperCede if you're focusing on Java development for desktop applications, but the product will also be competitive in the more crowded Web development area. We looked at an early beta of SuperCede that the company released to us a few weeks before a public beta became available on its Web site (www.asymetrix.com). The product should be shipping by the time you read this.

At first glance, SuperCede appears to be an unremarkable Java environment. Asymetrix has designed a very simple user interface, based on a multi-purpose window that accommodates visual component layout as well as source-code editing. The design is similar to the project window in Borland's Open JBuilder, except that where Borland has followed a browser metaphor, Asymetrix uses a more traditional approach. The SuperCede interface gets a bit more complex during debugging, when numerous other windows come into play.

Like most Java environments, SuperCede lets you design visually by dragging Java components onto a form. SuperCede creates Java source code

based on your form design. Double-clicking on a component will pop up a properties editor, and from there it's easy to specify the events that you want to program. For example, you'd typically want to handle the *on_click* event of a push-button control. These facilities in SuperCede work well, but they go no further than similar facilities in other Java environments.

If that is pretty standard stuff, SuperCede breaks significant new ground in other areas. SuperCede's interactive programming technology



SuperCede's interactive programming technology lets you modify an executing app.

lets you modify your program while it is running. You can add new functions, add controls to a form, and so on, all while the application continues to execute. When you've finished making changes, you click the Update button to incorporate those changes into the still-executing application. Of course, there are limits. You can't test changes to initialization routines, and you can't modify visible forms, because their data structures already exist. But

SuperCede's interactive programming is still a powerful feature, especially for developers of large applications or applications that are tedious to restart.

The second technical feat in SuperCede is in its dual nature as a combined Java/C++ environment. Both compilers are included in the product, and both share the same object model. That means you can define an object in Java and program some of its member functions in C++, or the reverse. In fact, the combination of the two languages, engineered to work together simultaneously, in a single programming environment gives you unparalleled flexibility. The only disadvantage of using C++ in an application is that you can't generate Java bytecodes from C++. To deploy an application on the Web, you must avoid C++. But for standard Windows applications, SuperCede's mix-and-match approach is very exciting.

The third technical feature that distinguishes SuperCede is its support for x86 native-code generation (in fact, our early beta version could compile *only* native x86 code, although Java bytecode generation is expected in the final product).

Anyone using Java for developing desktop Windows applications should take a look at SuperCede. Its interactive programming features are great for desktop-size projects, its solid support for native machine code makes it a natural for desktop development, and its ability to blend C++ and Java may be just what you need for an application that is already partly coded in C++.

adding your own code, Visual Café comes with a scriptable source-code editor that provides syntax highlighting for Java and HTML keywords. The editor's ScriptMaker macro editor made it easy to record and play back keystrokes.

Two separate tools help you manage your classes and the code behind them. The first, Class Browser, uses a three-pane interface to show the object, the members and methods, and the actual Java code associated with each. This tool

also lets you add new methods and members using a dialog-box interface. A second tool, Hierarchy Editor, lets you view and edit a group of Java classes or interfaces. Hierarchy Editor shows the relationships within a class hierarchy visually—including inherited functionality.

COMPONENT-BASED PROGRAMMING

Visual Café gives you a component-based programming model similar in feel to other popular RAD tools such as Borland

Delphi or Microsoft Visual Basic. The beta version that we tested came with 40 reusable controls; about 60 more are promised for the final release.

The basics of the Advanced Windowing Toolkit (AWT) are all here, from Labels, Choices, and TextField controls to more advanced elements such as slider controls, tree-view controls, and a timer control. The components in Symantec's Visual Café anticipate the proposed JavaBeans standard, although full JavaBeans

Star Buck: Built for Depth

By Kaare Christian

Powersoft's new Java product, code-named Star Buck (a final name had yet to be determined at press time), is an offshoot of Powersoft's well-regarded Optima++ RAD tool for C++ Windows development. We looked at Star Buck about a month before its scheduled beta release on Powersoft's Web site (www.powersoft.com). Commercial release is scheduled for the first quarter of 1997.

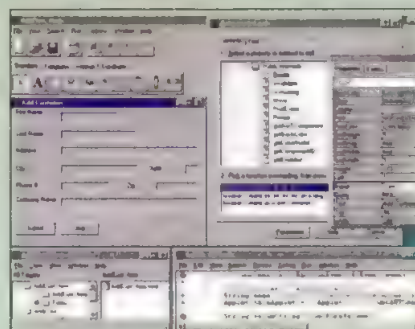
Star Buck addresses the broad problem of developing and deploying complex Internet applications. This approach contrasts with that of many other Java vendors, which focus on the problem of building applets. You can use Star Buck to build Java applets, but its project management features, integration with database software, and support for server-side Java are what makes the environment stand out.

If you've used the company's Optima++ development environment, you've seen a preview of Star Buck. Of course there are many new Java-related features, but overall, Star Buck looks a lot like Optima++ 1.5. The two products will remain separate, but Powersoft plans to share many aspects of the development environment, debugger, and so on. If you purchase both environments, they'll work together seamlessly, though you'll have to pick C++ or Java for each application.

Star Buck's form-design palette contains the usual selection of Java-Bean-compliant components, but you can easily add ActiveX components to the palette. When you import an ActiveX component, Star Buck auto-

matically wrappers it as Java, which then allows you to use standard Java methods to interact with the ActiveX component. In addition, all the visual design tools, such as the Reference Card window used to set component properties, work with imported ActiveX controls.

Star Buck's tools for managing projects are noticeably deeper than those found in other Java development environments. One feature that stands out is that you can specify an execution



Powersoft's Star Buck environment is based on the powerful Optima++ RAD tool.

environment for an applet. For quick turnaround, simply run your applet in the standard applet viewer. But for more realistic testing, you can specify that an applet run within a specific browser—Microsoft Internet Explorer, for example—whose debugging interface Star Buck supports.

Any complex Internet application will include static HTML pages, bitmapped graphics, script files, and other files that are created outside of Star Buck. To accommodate these external files, the Star Buck project manager lets you include those files in

your project, and it also lets you manually manage their dependencies. This is especially important when your Java code depends on the external files, or when you use the innovative Publish feature of the project manager to move your whole Internet application to its final destination.

If you are writing an Internet business application, you probably need to access databases. Star Buck has several data options. The simplest is JDBC, which is the standard for connecting Java to any supported database. The more interesting is Star Buck's NetImpact Dynamo. Powersoft's server-side tool for publishing SQL data via HTML Web pages.

If all you need is straightforward data access on an x86-based server, you can use NetImpact Dynamo alone to execute SQL queries and display the result in Web documents. But for more complex needs, you can use Star Buck to create a NetImpact Dynamo "servlet," Java code that will execute on the Web server in conjunction with NetImpact Dynamo.

This servlet is identical to a custom server application, except that it uses Java as the programming language and is closely tied to a SQL query engine. If you create Java servlets, you need to use a Web server for testing. Star Buck includes a personal Web server so you can test and debug servlets locally.

Overall, Star Buck is an environment that focuses on Internet development, leverages the existing Optima++ RAD technology, and naturally enables access of business data via the Web. Now all it needs is a name.

support will not be implemented until the release of the Sun Java Development Kit (JDK) 1.1.

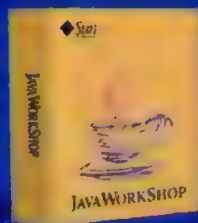
Programming with these components is simply a matter of placing controls on applet panels or other components, and changing their properties and events. You can set properties for any component in the Property List window. The Visual Café environment generates the code

needed to create and customize your control automatically.

Although image editing was not supported, we had no problem adding preexisting .GIF and JPEG images to an applet using the provided SlideShow component. SlideShow also let us create a simple animation easily, by adding a series of .GIF or JPEG image URLs that were displayed in succession.

Among the products we reviewed, Visual Café was the only one to support two-way editing of visual resources. If you move a control in a window, for example, its numerical position properties in code will change automatically. You can then edit code and the changes will be reflected back into the visual model. We found that rewriting the code entirely tended to confuse the two-way

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Java Tools

☐ YES ☐ NO

Products listed in alphabetical order

Java WorkShop 1.0

**Microsoft Visual J++
1.0, Professional Edition**

PC MAGAZINE
EDITOR: CHUCK

- Context-sensitive help
- Wizards or equivalents
- Cut-and-paste from online help
- User can customize and reuse desktop
- Third-party program launch from IDE
- Includes JIT compiler
- Supports JDK tools

Editor

- Syntax highlighting
- Remappable keys
- Macros
- Brief compatibility
- Epsilon compatibility

Programming Tools

- Wizard can generate applets
- Wizard can generate applications
- Wizard can add control events
- Wizard adds animation automatically
- Class browser
- Can browse uncompiled projects
- Graphical class-designer tool
- GUI resource designer
- Attaches code to controls in resource editor
- Supports .BMP/.GIF /.JPG graphics files
- Can import Windows resource script files
- HTML editor included
- Supports ActiveX components
- ActiveX creation in Java
- Supports JavaBeans
- Can target reusable components
- Provides classes for database connectivity
- Provides resolution-independent form design

Debugging

- Integrated debugger
- Includes browser with debugging hooks
- Debugger catches Java exceptions
- Breakpoints
- Watch variables
- Supports multithreaded debugging
- Supports remote debugging
- Integrated source control
- Disassembles Java byte code
- Applet viewer
- JavaScript/HTML debugging

N/A—Not applicable: The product does not have this feature.

facility, but generally this approach proved truly useful. It is clearly an advance over having to regenerate Java code from a visual interface each time you wish to make changes, which the other tools in this review force you to do.

By selecting a component from the Objects tab in the Project Window, you can also maintain control over events associated with that component. This is an

important feature, especially for those new to Java, because learning the event model in AWT isn't easy. As with most other RAD tools, Visual Café displays only those events associated with a particular component. You can add event handlers automatically just by selecting an event. Visual Café simply adds default code for you. If you change your mind or develop code incrementally, Visual Café lets you refine your design.

ADVANCED GADGETRY

The Interaction Wizard adds even more RAD-style visual programming capability by letting you program simple interactions just by dragging one object onto another. A fuzzy-logic module analyzes the possible interactions between these objects and generates a series of English statements, such as “Add a string to the list,” to let you control a number of simple events. The Wizard then automatically adds the new handlers to your code. This feature will be appreciated by beginners and even by expert users who want to save time designing the initial interface of a Java project. While this is not a true parts-based programming model, it certainly points in that direction.

On top of all this advanced gadgetry, Visual Café has real power under the hood. Its just-in-time (JIT) Java compiler produced some of the faster scores on our performance tests. As we went to press, Netscape announced plans to include Symantec's JIT in its Navigator browser. Obviously, we weren't alone in noting its strong performance.

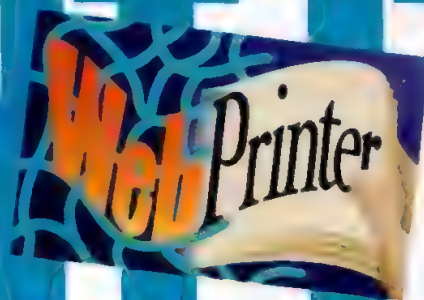
The debugger has all the low-level control that you'd expect from a traditional compiler, including watches and breakpoints, thread windows, and full control of Java exceptions. Visual Café even borrows a page from Microsoft in its use of ToolTips, which allow you to view any data on the fly by highlighting variables. Currently, you debug inside the Sun JDK applet viewer; Symantec plans to add support for Netscape Navigator debugging hooks when they become available.

For developers who are not C++ experts, Visual Café eases the transition to Java with a winning blend of traditional compiler power and the intuitive ease of a RAD tool. But Even C++ diehards will appreciate the ease and elegance of its visual, component-based programming. □

Visual Café 1.0. List price: \$199. Symantec Corp., Cupertino, CA; 800-441-7234; cafe.symantec.com. *Circle 492 on reader service card.*

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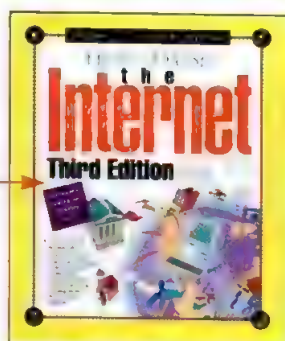


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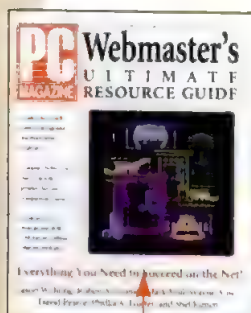
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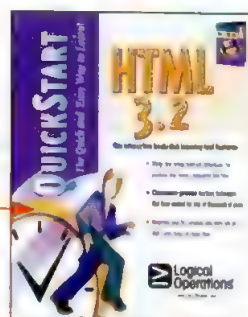
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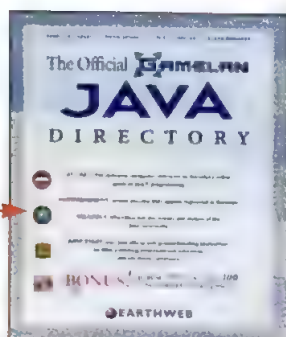


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TUTOR

Extending Internet Mail

A look at Multipurpose Internet Mail Extensions.

By Jeff Prosis

The Internet is a world built on protocols. Some, such as IP (Internet Protocol) and ARP (Address Resolution Protocol), work at the lowest levels to route packets of data to their destinations and translate Internet addresses into physical network addresses. Others, such as HTTP (HyperText Transfer Protocol) and SMTP (Simple Mail Transfer Protocol), are higher-level protocols that serve as the foundations for Web browsers, mail readers, and other Internet applications.

Lately, my in-box has been overflowing with questions about the Multipurpose Internet Mail Extensions protocol, better known as MIME—a specification for sending non-ASCII data over the Internet using ASCII mail protocols. Internet mail programs use MIME to transmit programs, video, sound, graphics, and other binary file types in the form of text-only mail messages. When a mail program receives a MIME message containing an MPEG video clip, for exam-

ple, it reconstructs the original MPEG data from the text of the mail message in preparation for playing it back. MIME adds a richness to the Internet that transcends the simple sending and receiving of e-mail messages, and it does so while remaining compatible with existing mail transport mechanisms—even those that are text-based.

COMMON MIME TYPES

Type	Subtype	Description
application	octet-stream	Raw binary data.
	postscript	A program written in PostScript.
audio	basic	Audio data stored in 8-bit ISDN mu-law format.
	midi	Audio data stored in MIDI format.
	wav	Audio data stored in .WAV format.
image	gif	Bitmapped image stored in .GIF format.
	jpeg	Bitmapped image stored in JPEG format.
message	rfc822	An RFC 822 mail message.
	partial	A fragment of a larger message.
	external-body	A reference to another message.
multipart	alternative	Multipart object containing the same information in two or more different formats.
	digest	Multipart object consisting of other mail messages.
	mixed	Multipart object with independent parts.
	parallel	Multipart object with dependent parts—for example, audio and video tracks that should be played in parallel.
text	html	HTML text.
	plain	Plain, unformatted text.
	richtext	Text with simple formatting (specified in RFC 1341).
video	mpeg	Video stored in MPEG format.
	quicktime	Video stored in Quicktime format.

IN THIS SECTION



POWER PROGRAMMING

The component object model (COM) provides a cross-platform, language-independent standard for interprocess communication, but until now the literature has focused on development in C++. That language is well-suited for COM, but we'll show you how to build a COM object using Borland's Delphi development environment. Doing so requires us to overcome Delphi's lack of support for multiple inheritance. *Page 227.*



UTILITIES

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ALSO IN THIS ISSUE Getting all your temp files to go to the same place; keep CD-ROM icons handy even when the CD's not in the drive; troubleshooting HP LaserJet conflicts in Windows 95; tips on low-level formatting hard disks; installing only one copy of a program so that it works with both Windows 95 and NT; device-driver installation under OS/2 Warp 4.0; eliminating an unwanted "Cannot Quit FoxPro" message, and more. *Page 281.*

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MIME ENCODING METHODS

Content-Transfer-Encoding	Description
7-bit	Not encoded; message contains 7-bit characters and includes line breaks.
8-bit	Not encoded; message contains 8-bit characters and includes line breaks.
base64	Converts each run of three 8-bit bytes into four 6-bit values represented by ASCII characters.
binary	Not encoded; message contains 8-bit characters and does not include line breaks.
quoted-printable	Replaces 8-bit characters with equal signs followed by two-digit hexadecimal character codes.

So how does MIME work? To answer this, we'll go under the hood to see what a MIME mail message looks like. Then we'll discuss the various methods that mail programs use to encode binary data in plain ASCII text, and we'll finish by talking very briefly about MIME on the Web.

MIME BASICS

MIME was created to circumvent a major limitation of Internet mail, whose format was defined in 1982, when e-mail messages consisted primarily of text. Not surprisingly, that format specifies the use of plain ASCII text, and nothing else. MIME extends the specification by allowing binary data to be repackaged in text form and transmitted over the Internet in mail messages that are compliant with the original specification.

Mail programs examine message headers to determine whether a message contains ASCII text or MIME data. A text-only e-mail message's header might look like this one:

```
From: jprosize@zd.com
To: 72241.44@compuserve.com
Subject: You Gotta See This!
[...Text of the message...]
```

MIME defines five additional fields that can be included in the Internet mail header. A message containing a JPEG image might have a header like this one:

```
From: jprosize@zd.com
To: 72241.44@compuserve.com
Subject: You Gotta See This!
MIME-Version: 1.0
Content-Type: image/jpeg
Content-Transfer-Encoding: base64
[...JPEG data...]
```

In the message header, the MIME-Version field specifies the MIME version (currently 1.0). Content-Type specifies the MIME type, in this case a JPEG image. Content-Transfer-Encoding specifies the method used to convert the bits and bytes in the JPEG image to ASCII text. The other two MIME field types (neither of which is included in the message above) are Content-ID, which assigns the MIME entity a unique ID to distinguish it

and jpeg, respectively. Image/jpeg is one of several officially sanctioned MIME data types. The table "Common MIME types" lists other types. Most of them—audio, video, and so forth—are self-explanatory. The *message* type allows mail messages to be packaged in other mail messages. *Multipart* means the message contains multiple parts; one use for the multipart content type is to create compound messages containing both graphics and text. The *application* type is a catchall for data types that don't fit neatly into any of the other categories.

Some Internet applications define private MIME types for their own use. A mail client that uses a proprietary bitmap format to transfer images, for example, might define a new image subtype called "x-myimageformat." The complete MIME type would then be *image/x-myimageformat*. The leading "x-" indicates x-myimageformat is an experimental subtype that isn't officially recognized by the Internet standards community.

New types and subtypes can be registered with the Internet Assigned Numbers Authority (IANA). MIME has already grown to include many subtypes not described in the original specification, and you can expect additional subtypes, and perhaps new types as well, to be added over time.

CONTENT ENCODING

A key part of any MIME message is the method used to

from other MIME entities, and Content-Description, a human-readable description of the MIME data—for example, "Satellite photo of the San Francisco Bay."

The Content-Type field is divided into type and subtype, in our example *image*

encode its data. Raw binary data is incompatible with many Internet mail systems, so it must be translated into ASCII text before it can be sent in a mail message.

The Content-Transfer-Encoding field in the message header identifies the encoding method. The table on the left lists the five possible values for this field. Our earlier example—a mail message containing a JPEG image—used base64 encoding, a process that divides data into 6-bit chunks and represents each chunk with an ASCII letter, numeral, or punctuation symbol, as shown in Figure 1. The program that receives the message can reconstruct the original data by reversing the base64 encoding process.

While base64 is useful for converting arbitrary streams of binary data to ASCII, it has the unpleasant side effect of swelling the data size by one-third. If an unencoded data stream consists mostly of 7-bit ASCII text with an occasional 8-bit character thrown in, the quoted-printable encoding method is more efficient. The idea behind quoted-printable encoding is simple: transmit 7-bit characters in raw form, but encode each 8-bit character as an equal sign followed by a two-digit hexadecimal character code. Thus, the string

BASE64 ENCODING

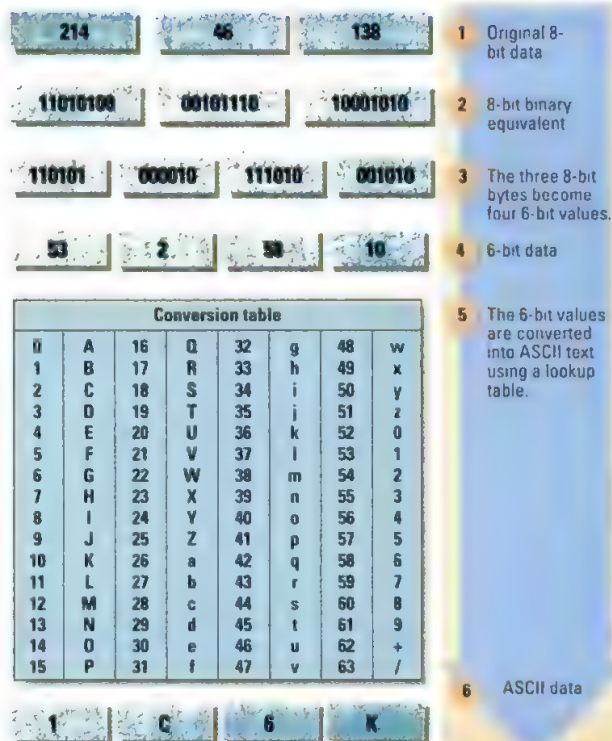


FIGURE 1: The base64 encoding method converts binary data to ASCII by partitioning each run of three 8-bit bytes into four 6-bit values, then replacing the four 6-bit values with four ASCII character codes. Here, the byte stream 214, 46, 138 is converted to 1C6K.

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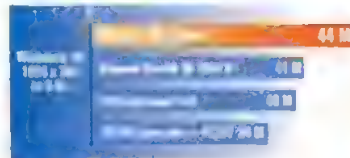


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All performance tests conducted by Matrox Graphics Inc. on a Gateway P5-166 configured with Intel P5-166MHz, 16MB of EDO RAM with 256K cache. The Matrox Millennium 128 Series 2 were and Diamond Stealth 64 3240XL were configured with 4 MB of memory using driver releases 3.14, 2.09 and 4.02.325 respectively. The STB Lightspeed 128 was configured with 2.25 MB of memory using driver release 1.22i, and could not be expanded to support 1024 x 768 @ 24-bit. Matrox Mystique, Diamond Stealth 3D 2000XL and ATI 3D XPERIENCE 1.0 were configured with 2 MB of memory for the PCI bus using driver releases 3.16, 4.03.00.2101, and 3.0 respectively for Windows 95. STB Lightspeed 128 was configured with 2.25 MB using driver release 1.22M. WinBench 95 1.0 tests conducted at 1024 x 768 resolution with 8-bit and 24-bit color at 75Hz refresh using large fonts under Windows 95.

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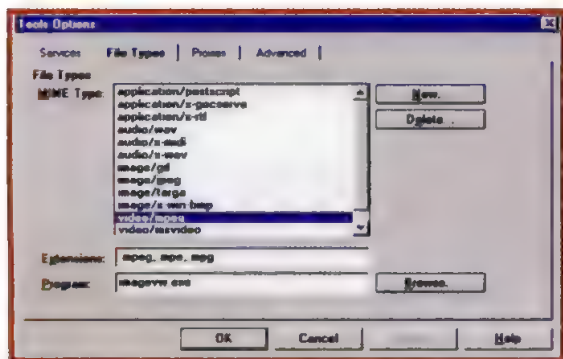


FIGURE 2: Most Web browsers can understand MIME content and can be configured to support new MIME types.

Copyright © 1996

becomes

Copyright =A9 1996

because the copyright symbol is an 8-bit character whose character code is hexadecimal A9.

The final three encoding methods—7-bit, 8-bit, and binary—aren't really encoding methods at all. They simply tell the receiver what kind of data the message contains. If a MIME message consists of 7-bit ASCII characters (no binary data) and no

line is longer than about 1,000 characters, it can be transmitted as is by setting Content-Transfer-Encoding to 7bit. Some Internet mail transport systems are capable of handling 8-bit data, in which case Content-Transfer-Encoding can be set to 8bit and text containing 8-bit characters can be transmitted in raw form—again, provided no line exceeds about 1,000 characters in length. A Content-Transfer-Encoding field equal to binary means the message contains 8-bit characters and there is no limit on the line length. It is typically used to send raw binary data.

MIME ON THE WEB

Internet mail programs aren't the only applications that use MIME. Most Web browsers understand MIME content, too, and are easily configured to support additional MIME types that aren't supported right out of the box.

The property sheet page in Figure 2 is part of CompuServe's SPRY Mosaic Web browser. The file name in the Program field tells the browser to use an external program named Imagevw.exe to view items whose MIME type is video/mpeg. SPRY Mosaic doesn't have an

MPEG viewer built in, but if it receives MPEG video in a MIME message or downloads a file with the extension .MPG, .MPE, or .MPEG, it will run Imagevw.exe as a helper application. If image/foo becomes next year's hot image file format and you're stuck with last year's browser, you can bring your browser up to date by adding image/foo to its list of MIME types and telling it what application you'd like to use to view foo files.

FURTHER READING

If you'd like to know more about MIME, the first thing to do is to obtain a copy of RFC 1521, "MIME (Multipurpose Internet Mail Extensions), Part One: Mechanisms for Specifying and Describing the Format of Internet Message Bodies." A related document, RFC 1522, describes an extension to RFC 1521 that permits non-ASCII character sets to be used in message headers. Other RFCs that may interest you include RFC 1741 ("MIME Content Type for BinHex Encoded Files"), RFC 1740 ("MIME Encapsulation of Macintosh Files"), RFC 1563 ("The Text/Enriched MIME Content-Type"), and RFC 1344 ("Implications of MIME for Internet Mail Gateways"). □

Jeff Prossie is a contributing editor of PC Magazine.

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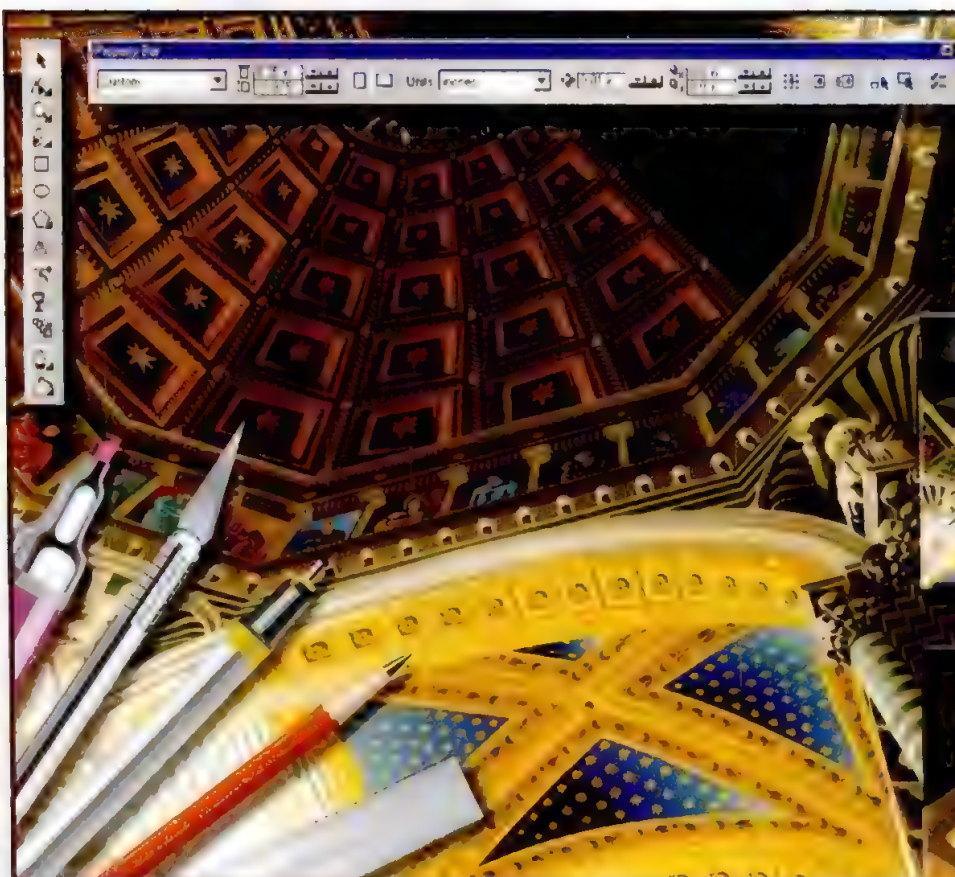
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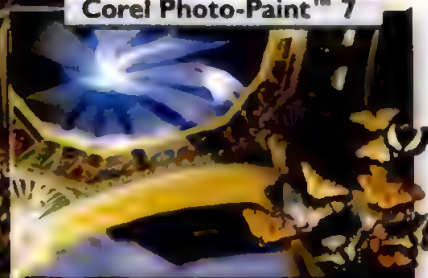


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PC Tech/Power Programming

By Neil J. Rubenking

COM Objects in Delphi, Part 1

What it takes to overcome Delphi's lack of multiple inheritance.

The PC software development community is segregated by platform and programming language. I program with Delphi for Windows, you program in assembly language for DOS, and she programs in C++ for OS/2. Expertise developed on one platform doesn't necessarily apply to another, and skill in one programming language may actually hinder learning another. And inter-process communication, which has the potential to break down these barriers, is made difficult by differing internal representations of data.

But there is one way to bridge the gap—with a language-independent, cross-platform standard for communication between objects: Microsoft's Component Object Model (COM).

And COM is here now; it's the essential technology underlying OLE and ActiveX.

Unfortunately, the current literature's COM programming examples don't demonstrate much language-independence. All but a very few use C++. Some examples are straight C++ code and take advantage of the language's multiple inheritance. Others are built on MFC and rely so heavily on COM-specific macros that the result isn't even recognizable as C code. The bottom line: If C++ isn't your development language, you're at a disadvantage when it comes to learning COM programming.

In this column and a follow-up, we'll discuss the implementation of COM objects using Borland's Delphi development environment. This first part explains the problems involved

in a Delphi COM implementation and demonstrates some solutions. The next article will show five specific COM objects—implementations of five standard Windows 95 shell extension types. Under some circumstances, COM objects can reside in .EXE files. But for the sake of simplicity, this article will deal with only the more commonly used COM objects that reside in DLLs.

COM OBJECT ESSENTIALS

What's inside a COM object? That's none of your business! A COM object shares information with the world only through defined *interfaces*. Each interface provides one or more functions that another object or a program can call. Every COM object must support the

```
unit DelphCom;
// "generic" objects for creating COM objects in Delphi.
// ISatelliteUnknown is an interface object that's meant
// to be contained by IContainerUnknown. Each actual COM
// object that needs to support more than one interface
// will descend from IContainerUnknown, and will implement
// QueryInterface.
interface
USES Windows, Ole2, Classes, SysUtils, ShellApi, ShlObj;

VAR DllRefCount : Integer;
type
  IContainerUnknown = class;

  ISatelliteUnknown = class(IUnknown)
  // Meant to be contained by an IContainerUnknown
  // Reflects the three IUnknown functions to its
  // container.
  protected
    fContainer : IContainerUnknown;
  public
    constructor Create(vContainer: IContainerUnknown);
    function QueryInterface(const WantIID: TIID;
      var ReturnedObject): HRESULT; override;
    function AddRef: Longint; override;
    function Release: Longint; override;
  end;

  IContainerUnknown = class(IUnknown)
  protected
    FRefCount : Integer;
  public
```

```
    constructor Create;
    destructor Destroy; override;
    {IUnknown functions}
    function QueryInterface(const WantIID: TIID;
      var ReturnedObject): HRESULT; override;
    function AddRef: Longint; override;
    function Release: Longint; override;
  end;

  IMyClassFactory = Class(IClassFactory)
  private
    FRefCount : Integer;
  public
    constructor Create;
    destructor Destroy; override;
    function QueryInterface(const WantIID: TIID;
      var ReturnedObject): HRESULT; override;
    function AddRef: Longint; override;
    function Release: Longint; override;
    // descendant MUST implement CreateInstance
    function LockServer(fLock: BOOL): HRESULT; override;
  end;

function DLLCanUnloadNow : HRESULT; StdCall; Export;

implementation

(***** ISatelliteUnknown *****)
constructor ISatelliteUnknown.Create(vContainer:
  IContainerUnknown);
begin
  fContainer := vContainer;
  (continues)
```

FIGURE 1: These generic COM interface objects aid in creating Delphi-based COM objects that support multiple interfaces.


```

end;

function ISatelliteUnknown.QueryInterface(const WantIID:
TIID;
var ReturnedObject): HRESULT;
begin
    Result := fContainer.QueryInterface(WantIID,
    ReturnedObject);
end;

function ISatelliteUnknown.AddRef: LongInt;
begin
    Result := fContainer.AddRef;
end;

function ISatelliteUnknown.Release: LongInt;
begin
    Result := fContainer.Release;
end;

(***** IContainerUnknown *****)
constructor IContainerUnknown.Create;
begin
    Inherited Create;
    FRefCount := 0;
    Inc(DllRefCount);
end;

destructor IContainerUnknown.Destroy;
begin
    Dec(DllRefCount);
    Inherited Destroy;
end;

function IContainerUnknown.QueryInterface(const WantIID:
TIID;
var ReturnedObject): HRESULT;
VAR P : IUnknown;
begin
    IF IsEqualIID(WantIID, IID_IUnknown) THEN
        P := Self
    ELSE P := nil;
    Pointer(ReturnedObject) := P;
    IF P = NIL THEN Result := E_NOINTERFACE
    ELSE
        begin
            P.AddRef;
            Result := S_OK;
        end;
end;

function IContainerUnknown.AddRef: LongInt;
begin
    Inc(FRefCount);
    Result := FRefCount;
end;

function IContainerUnknown.Release: LongInt;
begin
    Dec(FRefCount);
    Result := FRefCount;
    IF FRefCount = 0 THEN Free;
end;

```

```

end;

(***** IMyClassFactory *****)
constructor IMyClassFactory.Create;
begin
    Inherited Create;
    Inc(DllRefCount);
    FRefCount := 0;
end;

destructor IMyClassFactory.Destroy;
begin
    Dec(DllRefCount);
    Inherited Destroy;
end;

function IMyClassFactory.QueryInterface(const WantIID:
TIID;
var ReturnedObject): HRESULT;
begin
    IF IsEqualIID(WantIID, IID_IUnknown) OR
    IsEqualIID(WantIID, IID_IClassFactory) THEN
        begin
            Pointer(ReturnedObject) := Self;
            AddRef;
            Result := S_OK;
        end
    ELSE
        begin
            Pointer(ReturnedObject) := NIL;
            Result := E_NOINTERFACE;
        end;
end;

function IMyClassFactory.AddRef: LongInt;
begin
    Inc(FRefCount);
    Result := FRefCount;
end;

function IMyClassFactory.Release: LongInt;
begin
    Dec(FRefCount);
    Result := FRefCount;
    IF FRefCount = 0 THEN Free;
end;

function IMyClassFactory.LockServer(fLock: Bool): HRESULT;
begin
    Result := E_NOTIMPL;
end;

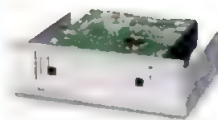
(***** exported function *****)
function DLLCanUnloadNow: HRESULT; StdCall; Export;
begin
    IF DllRefCount=0 THEN Result := S_OK
    ELSE
        Result := S_FALSE;
end;

initialization
    DllRefCount := 0;
end.

```

FIGURE 1 (CONT.)

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IUnknown interface and its three functions, `AddRef`, `Release`, and `QueryInterface`. `AddRef` and `Release` handle the mundane task of managing the object's life span. Each call to `AddRef` increments the object's *reference count*, and each call to `Release` decrements the reference count. The object is destroyed when the reference count goes to 0. The utterly essential function of the IUnknown interface is `QueryInterface`. Once a program or another object gets access to the always present IUnknown interface, it can call `QueryInterface` to access all other interfaces supported by the object. IUnknown is the root of all COM interfaces. Every other COM interface is effectively a descendant of IUnknown and thus must also provide implementations of the three IUnknown functions.

The concept of *object* in COM terminology isn't quite the same thing as the concept as it relates to Delphi or C++. A COM *interface*, however, is similar to a Delphi or C++ object that has no public data members and only virtual methods. The interface's list of functions corresponds directly to an Object Pascal or C++ object's virtual method table. In fact, you can create a COM interface in either language simply by declaring an object with the correct list of virtual methods. The method declarations must match the function definitions for the desired interface, naturally, but they must also appear in the correct position in the virtual method table. That means the methods must be declared in the defined order and no other virtual methods can precede them.

The OLE2.PAS file that comes with Delphi 2.0 defines an IUnknown interface object type and dozens of IUnknown descendants, such as

IClassFactory, IMarshal, and IMalloc. Each of the supplied objects' interface function methods is declared as `virtual`, `stdcall`, or `abstract`. The `virtual` keyword is required, as noted above. The `stdcall` keyword instructs the compiler to use the standard calling convention for the method. The `abstract` keyword indicates that the method is not implemented in the object itself but *must* be implemented in any descendant for which an instance is created. More than 50 direct descendants of IUnknown are defined in OLE2.PAS, and each one supports both the interface for which it is named and IUnknown.

A problem arises when a COM object needs to support two or more interfaces other than IUnknown. The C++ implementation simply defines the COM object as multiply inheriting from the objects representing the interfaces it needs to support. An object in Delphi doesn't support multiple inheritance, so a different approach is required. (C++ programmers may be interested to note that an MFC-based COM object uses the same approach as described below for Delphi, a fact obscured by the complex set of macros used to define a COM object with MFC.)

SATELLITES AND CONTAINERS

The key to creating COM objects with multiple interfaces with Delphi involves treating the COM object as a *container* for its interfaces. A COM object does not have to be every interface object that it supports. It simply must *supply* the interface on demand, when the `QueryInterface` function of its IUnknown interface is called. The Delphi-based COM object handles the three IUnknown functions directly and returns a pointer to it-

self when the IUnknown interface is requested via `QueryInterface`. It acts as a container and manager of other objects that implement other interfaces. The *satellite* interface objects "reflect" the three IUnknown functions to their container. When a request arrives for one of the satellite interfaces (as usual, via `QueryInterface`) the container returns a pointer to the satellite object. Figure 1 shows the Delphi implementation of the satellite and container types of interface objects, along with a corresponding IClassFactory interface.

SATELLITE OBJECTS

The ISatelliteUnknown object type descends directly from the supplied IUnknown type and necessarily overrides the abstract methods corresponding to the three IUnknown functions. ISatelliteUnknown has a single protected data field called `FContainer`, of type IContainerUnknown (defined below), which is initialized in its `Create` constructor. The implementations for the three IUnknown functions simply return the result of calling the corresponding method in the container object. Depending on which interface it has requested, the calling program may gain access to the `QueryInterface`, `AddRef`, and `Release` functions directly through the container object or through any of its satellite objects.

If you've read much OLE literature, you'll realize that the names used in Figure 1 for the parameters to `QueryInterface` in the Delphi-COM unit shown here are nonstandard. Usually the parameter representing the ID of the desired interface is named `riid`, and the parameter representing the returned object is

GUIDs, CLSIDs, and IIDs

Creating and managing COM objects relies heavily on Globally Unique Identifiers, or GUIDs (pronounced "GOO-ids"). A GUID is a 128-bit number generated by the Windows API function `CoCreateGUID`. GUIDs should be globally unique: `CoCreateGUID` should never return the same GUID twice. As OLE maven Kraig Brockschmidt (of Microsoft's OLE design team) puts it, the likelihood of two calls to `CoCreateGUID` returning the same value is "about the same as two random atoms in the universe colliding to form a small California avocado mated to a New York City sewer rat."

Every interface needs an Interface ID (IID), which is a GUID. Delphi's OLE2.PAS file defines dozens of IIDs. The example code for this article refers to IID_IUnknown and IID_IClassFactory; the Delphi-supplied OLE2.PAS file contains dozens more IIDs. In addition, every object class registered with the system needs a Class ID (CLSID). If you've ever looked at the Registry key `HKEY_CLASSES_ROOT\CLSID` with RegEdit, you've seen dozens or even hundreds of these unintelligible strings of numbers. These are the class IDs of all the COM objects registered on your system. No question about it; to do COM programming

you'll have to work with existing GUIDs as well as create new GUIDs specific to your program.

Free utilities, such as UUIDGEN.EXE, will generate GUIDs for you, but you'll then be faced with the tedious task of rewriting them in the correct form for a Delphi constant. Instead of UUIDGEN.EXE, use the text-mode "console" program available from PC Magazine Online. You can either load it into the Delphi IDE and compile it, or you can compile it with the command line Delphi compiler by entering `DCC32 GUIDS.DPR`. Run the resulting program, and you'll get a brand-new, never-before-seen GUID, expressed first as a string and then as a Delphi typed constant.

When you start a new project, mentally count up the number of distinct GUIDs you'll need, add a few for good luck, then pass that number to GUIDS.EXE, redirecting the output of GUIDS.EXE to a file. The resulting file will contain as many GUIDs as you requested, and, normally, they will form a continuous block of numbers. Having all the GUIDs used by your project differ in just one digit makes them easier to recognize as related. Now you can cut GUIDs from this text file and paste them into your project as needed.

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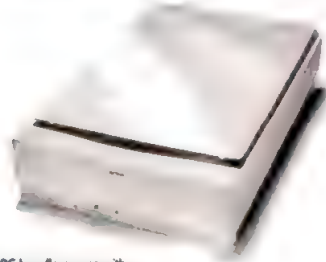
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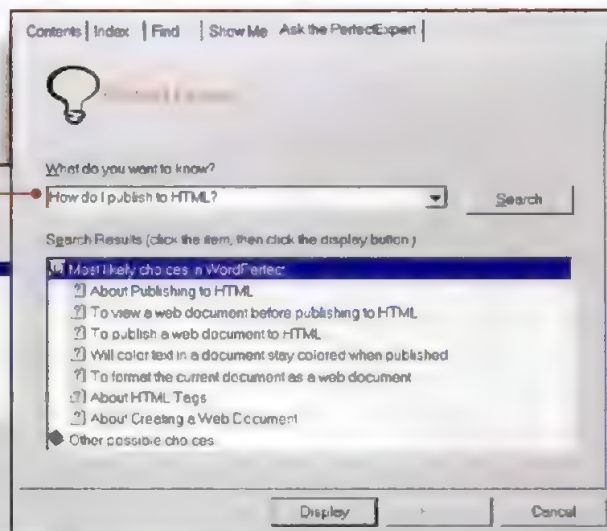
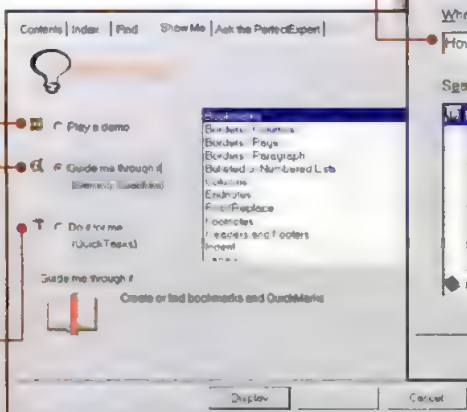


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called `ppv`. Since the names of the parameters have no significance outside of the object, I have replaced the cryptic standard names with the more intelligible `WantIID` and `ReturnedObject`.

CONTAINER OBJECTS

The `IContainerUnknown` object type is another direct descendant of `IUnknown`. It maintains its own reference count as a protected data field named `FRefCount`; the `AddRef` function increments `FRefCount` and the `Release` function decrements it. Both `AddRef` and `Release` return the new reference count; in addition, if the count has reached 0, the `Release` function frees the object.

The DelphiCOM unit also defines a global reference count for the entire DLL that contains descendants of the generic COM objects. The constructor and destructor of the container object increment and decrement, respectively, the global reference count. Every DLL that contains COM objects is required to supply two specific functions, `DLLCanUnloadNow` and `DLLGetClassObject`. `DLLCanUnloadNow`, implemented in the DelphiCOM unit, returns `False` unless the global DLL reference count is 0. `DLLGetClassObject` will be specific to each DLL that relies on DelphiCOM and can't be written until the COM objects (descendants of `ISatelliteUnknown`

and `IContainerUnknown`) have been defined.

The `IContainerUnknown` object responds to a `QueryInterface` request for the `IUnknown` interface by returning a pointer to itself. If any other interface is requested, it returns the error code `E_NOINTERFACE`. In a descendant of `IContainerUnknown`, the `QueryInterface` function will first call this inherited function. If the inherited method returns `E_NOINTERFACE`, the descendant will check the requested interface ID against the additional interfaces it supports, and return the satellite object that matches the request.

THE CLASS FACTORY

COM objects can be created on command from the system or a program. The actual creation is handled by a COM object type called a *class factory*, another direct descendant of `IUnknown`. The `IMyClassFactory` object in the DelphiCOM unit implements `AddRef` and `Release`, just as the `IContainerUnknown` object did. It responds to `QueryInterface` requests for `IUnknown` or `IClassFactory` by returning a pointer to itself. Besides those three functions, the `IClassFactory` interface adds two new ones, `CreateInstance` and `LockServer`. Since `LockServer` is not generally required, `IMyClassFactory` returns the special value `E_NOTIMPL`, indicating the function is not implemented.

The most essential function of a class factory, the one that makes it a factory, is `CreateInstance`. The calling program uses `CreateInstance` to produce an instance of the desired object. The DelphiCOM unit, however, doesn't contain any "finished" objects; it holds only the generic satellite and container objects. When we define a COM object descendant of `IContainerUnknown`, we also need to define an `IMyClassFactory` descendant whose `CreateInstance` function returns an instance of that COM object.

With the introduction of `IMyClassFactory`, the set of generic COM objects for Delphi is complete. The system of container and satellite objects can be used in any object-oriented language, and, in fact, COM objects designed under MFC use a similar system. Part 2 of this article will move from theory to practice. It will extend the generic objects defined in Part 1 to create examples of five Windows 95 shell extension types: a context-menu handler, a property-sheet handler, a right-drag handler, an icon handler, and a copy-hook handler.

Once you use and understand the examples, you'll be completely prepared to build your own practical extensions to the Windows 95 shell. □

Neil J. Rubenking is the contributing technical editor of PC Magazine.

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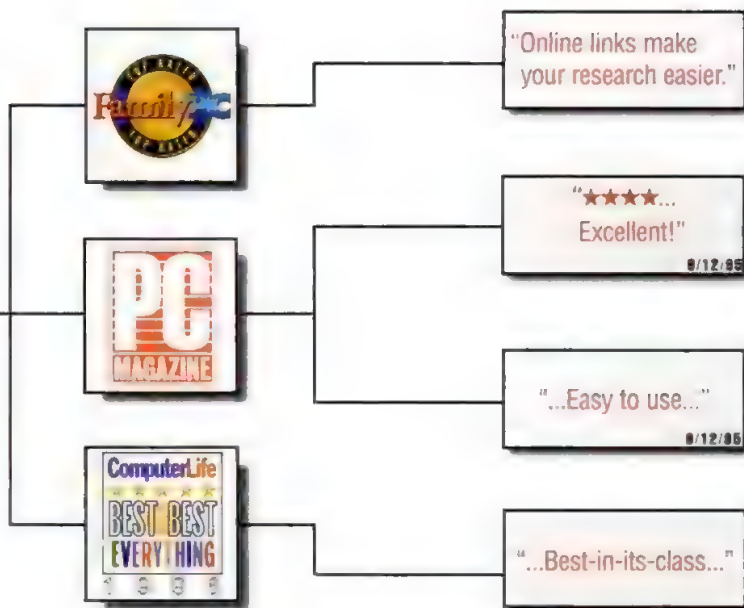


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By Neil J. Rubenking

Relocate Without Reinstalling

COA lets you change the addresses of 32-bit Windows programs.

When you install a new Windows application, a web of system references binds it to the drive and directory you chose at installation time. If you move the program later to a different drive or directory, chances are good that it will no longer work, because the system is still looking for it in the old location.

The popular *PC Magazine* utility COA (Change of Address), which was designed for use with 16-bit Windows, updates references in .INI files, Program Manager group files, and the Registration Database. But if you're running a 32-bit Windows platform—Windows 95, Windows NT 3.51, or Windows NT 4.0—COA won't do the job for you. The 32-bit Registry is very different from the old Registration Database, so COA can't read or change Registry references. Program Manager survives in Windows NT 3.51, but it no longer uses the .GRP files that COA understands. And COA knows nothing of the shortcuts that are such an essential part of the Windows 95 and Windows NT 4.0 user interface.

This issue's utility, COA32, is an all-new version of COA, rewritten from the ground up as a 32-bit program and redesigned for ease of use. It updates references in .INI files, Program Manager groups, shortcuts, and the 32-bit Registry. You can control how thorough (and time-consuming) COA32's search will be, and you can review a list of found items and reject any spurious "hits" before COA32 makes its changes. At the end of the process, COA32 presents you with a log of the changes it has made.

You can obtain COA32 by downloading it from PC Magazine Online or by mail. (Refer to the sidebar "Getting the Files" for details.) The source code for COA32, which was written with Delphi, Borland's visual program-

ming tool, is also provided, for those interested in seeing how it works.

INSTALLING AND UNINSTALLING

To install COA32, simply copy the files COA32.exe, COA32.hlp, and COA32.cnt to a directory on your hard disk. You may wish to place a shortcut to COA32.exe in one of your Start menu folders, or, because this is a utility you'll use only occasionally, you may prefer to run it from the Start menu's Run option.

If you decide to uninstall COA32, run COA32.exe from the Start menu's Run command, and add the string `CleanRegistry` to the command line. That will clear COA32's own

IN THIS ISSUE

COA32

COA32, a 32-bit Windows version of the popular PC Magazine utility COA, runs under Windows 95 and Windows NT 3.51 or higher. COA32 lets you change the drive or directory of a Windows program without having to reinstall it.



Registry settings without actually running the program (though the main window may appear briefly). To complete the uninstall, delete the three files you originally copied to your hard disk, along with the COA32.gid and COA32.fts files that WinHelp may have created.

USING COA32

Each page of COA32's multipage wizard interface represents one step in the process of informing the system about a program's change of address. The Next button moves to the next page; it is disabled when you can't go any further. On the first page, for example, the Next button is disabled until you have entered the program's old address. The Prev button moves to the previous page, so you can go back and forth to adjust your options. It will be disabled when you can't go back. For example, when COA32 has performed its search, you can't go back and change the search options.

For pop-up help with individual components on COA32's pages, click the question-mark icon in the title bar and then click on the component. Or, if you prefer, right-click on the component and choose What's This? from the pop-up menu. Do the same thing outside of any component and you'll get general help for the page you're on. You can also get help for a page by pressing F1 or clicking on the Help button.

SETTING SEARCH OPTIONS

To update a program's address with COA32, start by entering the old and new address strings in the boxes on the first page (see Figure 1). Each edit line is followed by buttons for browsing folders and files. The name you select using these buttons is copied into the corresponding edit line. You'll have a chance to make changes to the new address after you've seen the items found by COA32 for updating. Note that COA32 ignores upper- and lowercase when searching for the old address.

The old and new address strings should be parallel in structure and complete. For example, if you moved the one-file utility FooBar.exe from C:\FOOBAR to D:\UTILS,

FOR PROGRAMMERS ONLY Because COA32 is not the type of program that is used day in and day out, author Neil J. Rubenking designed a wizard-like interface that prompts the user each step of the way. He used the Delphi notebook component to implement his design. The full source code for COA32 and an expanded version of the article that discusses the programming techniques used can be found on PC Magazine's Web site (www.pcmag.com). COA32 demonstrates

- how to read and modify the contents of a system shortcut using the IShellLink COM object;

- how to read and modify Program Manager groups in Windows NT 3.51; and
 - how to launch Delphi thread objects sequentially, rather than simultaneously.
- Support for the free utilities offered by PC Magazine can be obtained electronically in the Utilities section of ZD Net's TIPS Forum (GO ZNT:TIPS). The authors of current utilities generally visit this forum every day. You may find an answer to your question simply by reading the messages posted in the forum. If the author is not available and the forum sysops can't answer your question, the Utilities column editor, who also checks this forum each day, will contact the author for you.

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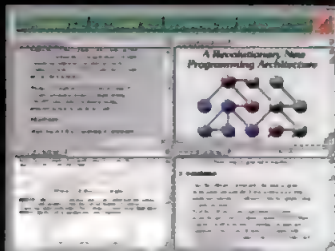
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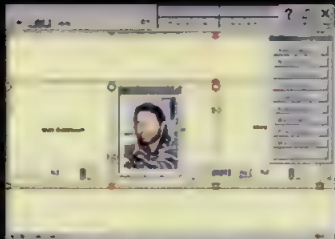
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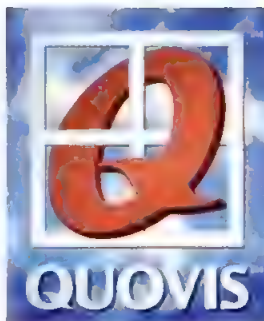
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you'd use C:\FOOBAR\Foobar.exe and D:\UTILS\Foobar.exe as the old and new addresses. If you also moved Foobar.hlp or other essential files with the same filename but different extensions, you could use C:\FOOBAR\Foobar. and D:\UTILS\Foobar. for the two strings. And if you moved an entire complex application with its DLLs, COM objects, and other files, you would use C:\FOOBAR\ and D:\UTILS\ as the old and new strings. The button above the address lines displays a green light (no problems), yellow light (warning), or red light (possible problem), depending on COA32's analysis of your input. Click on this button for an explanation.

It's always possible that your search will net some items that you didn't really want. For example, if you omit the final backslash in C:\FOOBAR\, COA32 might erroneously find C:\Foobarge. That's why you get a chance to review the found items.

On the next page, you select which .INI files you want COA32 to search. Searching every folder on every drive is the most thorough option, but it's also the most time-consuming. If you're quite sure that the program you're moving does not use a private .INI file, you can choose to search only WIN.INI and SYSTEM.INI. If it has a private .INI file stored in the Windows directory, or if you know that another Windows-owned file, such as CONTROL.INI or WINHELP.INI, references the program, search all .INI files in the Windows directory. COA32 lets you choose a balance between speed and thoroughness.

You'll notice a box titled Skip This Page in the Future at the bottom of the page. If you've decided always to search all folders for .INI files, you can make that choice and then check the skip box. Every time you run COA32, the program will skip that page and automatically use the option you've selected. Changed your mind? No problem. Just go back to the first page, check the box titled Show all pages, and COA32 will show you everything.

If you're running Windows NT 3.51, Program Manager groups are next. Always tell COA32 to search Program Manager groups unless you're using another shell program. As before, you can make the choice once and then check the skip box at the bottom of the page. Windows 95 and Windows NT 4.0 don't use Program Manager groups, but if you check the Show all pages box, you'll see this page regardless.

In place of Program Manager groups, Windows 95 and Windows NT 4.0 use shortcuts. Under these two platforms, shortcut options immediately follow .INI file options. Most of the icons on your desktop are shortcuts, as are almost all of the items in and below your Start menu. In most cases, the option that checks the Desktop and the Start menu will be sufficient. If your system includes multiple user

profiles, tell COA32 to search in and below the Windows directory. It's rarely necessary to search the entire system for shortcuts. Again, if you check the Show all pages box, you'll see this page even under Windows 3.51, which doesn't use shortcuts.

Whichever platform you're using, the next page's options control how much of the Registry COA32 will search. Searching the entire Registry can take quite a while, so COA32 lets you restrict the search to the two most commonly used root keys: HKEY_CLASSES_ROOT (HKCR) and HKEY_CURRENT_USER (HKCU). Under Windows 95, you get the option of adding HKEY_CURRENT_CONFIG (HKCC). And once you've made a choice, you can check the skip box to avoid having to make the same choice again.

The next page is *always* skipped, unless you've checked the Show all pages box. It has a skip box at the bottom, but that's just for information—you can't remove the check. This page lists Registry keys that COA32 will ignore. A key might be ignored for one of the following reasons:

- **Duplication.** Some of the root keys in the Registry are really just pointers to branches below other root keys. COA32 doesn't waste time searching these branches twice.
- **Security.** Under Windows NT, certain Registry keys can be viewed or changed only by using specialized security functions. COA32 ignores these keys.
- **Volatility.** Under Windows NT, the HKEY_LOCAL_MACHINE\Hardware key is re-

HKEY_CLASSES_ROOT	HKCR
HKEY_CURRENT_USER	HKCU
HKEY_CURRENT_CONFIG	HKCC
HKEY_USERS	HKUS
HKEY_LOCAL_MACHINE	HKLM

For example, to ignore COA32's own Registry key, you would create a value with the name HKCU\Software\PC Magazine\COA32.

The next page lists the choices you've made. It's important that you double-check them all, especially if you've checked some of the skip boxes. If you find a mistake, just back up (use the Prev button) and correct it. If the option page you want doesn't appear, go back to the first page and check the Show all pages box. When you're ready, return to the Search Options Summary page and click Next to begin searching. Once the search starts, you can't change the search options.

SEARCHING THE SYSTEM

COA32 now begins combing through your system for references to the old address. Its cursor changes to an hourglass, indicating that the program is busy, and both the Next and Prev buttons are disabled. You can still click on Cancel to quit the program, however, and you can view and interact with the Found Items list (more on that list in a moment). COA32 keeps you apprised of its progress by displaying what it's searching and where the search subject is located. When the search is complete, it displays the items found for your review (see Figure 2).

You can go through this list and select items that COA32 should not change by changing the green-light Y icon to a red-light N icon. Double-click on an item to toggle it from Y to N or back; press the Spacebar to toggle all selected items. Or right-click for a menu that lets you toggle all selected items or set them all to Y or N. The context menu also includes a What's This item that describes the row on which you right-clicked.

The Found Items list displays five columns: Item, Path, Type, Subtype, and Context. Type is one of four three-letter codes: INI (.INI file), GRP (Program Manager group), LNK (shortcut), or REG (Registry). Counts of found items by type are displayed at the top of the page. For INI and LNK items, the Item column contains the filename, and the Path column is the path in which the file was found. GRP items display the Program Manager item name in the Item column and the group name in the Path column. REG items display the Registry key in the Item column and its full path in the Path column.

The Subtype column is another three-letter code, this one describing where the old address was found. Its possible values are arg, cmd, dat, lco, key, sec, val, and wrk. INI items

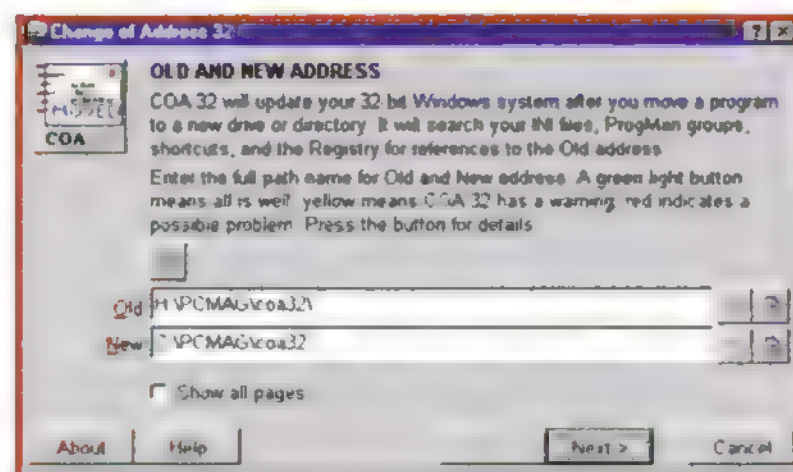


FIGURE 1: Each of COA32's pages represents a single step in the program's progress; this first page requires you to enter the old and new address strings.

created by the system at start-up, so there's no point in searching it.

- **User-defined conditions.** Just in case problems crop up in the future, COA32 allows you to define the keys you wish to be ignored.

You probably won't ever need to do it, but here's how to add a user-defined item to the list of keys COA32 will ignore. Launch the Registry Editor and navigate to HKEY_CURRENT_USER\Software\PC Magazine\COA32\0.1\Registry Keys To Ignore. Add a new named value to this key. For the value's name, use the full pathname of the key to ignore, exactly as it appears in the Registry, but with the root key replaced by one of the following four-letter codes:

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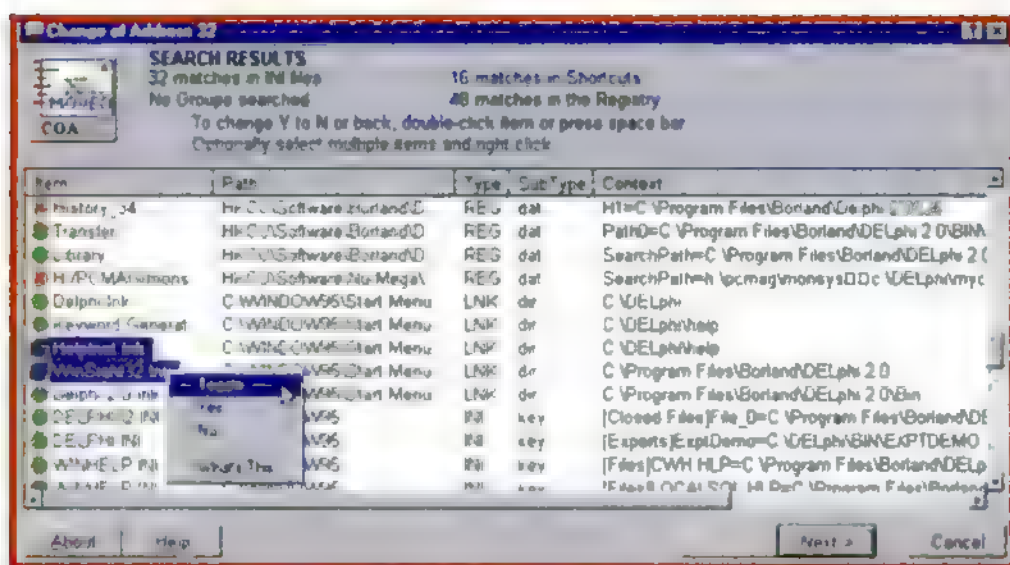


FIGURE 2: COA32 displays all the found instances of the old address string and lets you choose whether to change them.

can be sec (section heading) or key. GRP and LNK items can be cmd (command line), fco (icon location), or wrk (working directory). LNK items can also have the arg (command line arguments) subtype. REG items can be key (key name), val (value name), or dat (value data). In each case the Context column contains the string in which the old address was found.

Clicking on any of the column headings sorts the list by that column; clicking on the same heading twice in a row sorts by that column in the reverse direction. You can widen or shrink the columns by dragging the edges of their headings.

When you're done making your selections, click Next. The next page gives you the opportunity to save the list of references to the old address. Click the Save List button to store the marked items from the list in table form in an .RTF (Rich Text Format) file. You can view or edit the file using almost any Windows word processor.

TIME FOR A CHANGE

The next page, titled Search Complete, displays the old and new address strings again and gives you a last chance to change the new

error as well. When it has finished processing an .INI file, COA32 attempts to give the old file the extension .BAK and give its temporary file (extension .\$\$\$) the extension .INI. If any portion of this process fails (perhaps another program is holding an existing .BAK file open), COA32 logs the error, along with the current name of the updated file.

Windows NT 3.51 stores its Program Manager group information in the Registry using an arcane binary format. COA32 doesn't try to tweak the binary data. Instead, it engages in a DDE conversation with Program Manager to get information about the group items and to make any necessary changes. That means if you're using a shell other than Program Manager in Windows NT 3.51, COA32 may not be successful at updating groups. Shortcuts in Windows 95 and Windows NT 4.0 are stored as files with the extension .LNK, but the file format is officially undocumented. To get access to shortcuts, COA32 quizzes the .LNK file using a COM object (or, in last year's terminology, an OLE object).

Finally, COA32 makes the requested changes to the Registry. Problems are most likely to occur at this stage, as it may be impossible to rename a particular key or value.

address. You can't change the old address, of course, because the search is over. If you have entered a new address, clicking Next will begin the process of modifying each Y-marked item. Do not try to interrupt COA32 during this phase.

COA32 notes each replacement in an activity log. If a problem occurs (such as another program changing a key after the search phase), it logs the

If the desired new name already exists, COA32 can't make the change and logs the error. If the new and old names differ only in case, COA32 can't make the change. But since case is ignored in Registry key and value names, COA32 logs the occurrence without calling it an error.

Once all the replacing action is complete, COA32 displays its Done page, which is dominated by the activity log. It's extremely important that you review the log, since it lists any problems COA32 encountered. You'll want to press the Save Log button to dump the activity log to a text file, which will be handy if you need to reverse COA32's work. In some cases, you can reverse a change by running COA32 again, reversing the old address and new address strings. But that's only possible if the system contained no references to the new address before COA32 did its work. The safest course is to step through the activity log and reverse each change manually.

IT SLICES, IT DICES . . .

COA32 is designed as a tool for locating a file or folder name throughout your system and replacing it with a new name. But you can use it for other purposes as well. For example, you can enter a word like "taskbar" or "explorer" for the old address, and search only the Registry for all occurrences. As long as you leave the new address string blank, there's no danger of accidentally changing things.

COA32 lets you move Windows programs from one drive or directory to another without having to reinstall them. Its wizardlike interface tells you what to do each step of the way. COA32 automates the tedious and error-prone process of changing a program's address, letting you monitor and control each step in the process. □

Neil J. Rubenking is technical contributing editor of PC Magazine.

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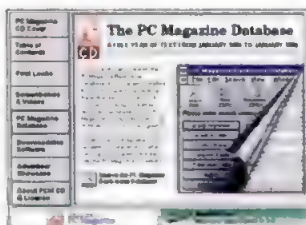
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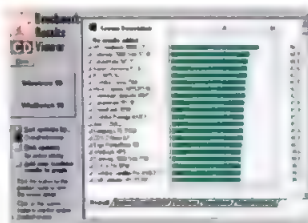
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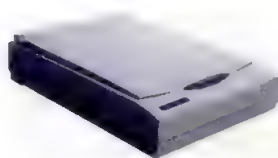
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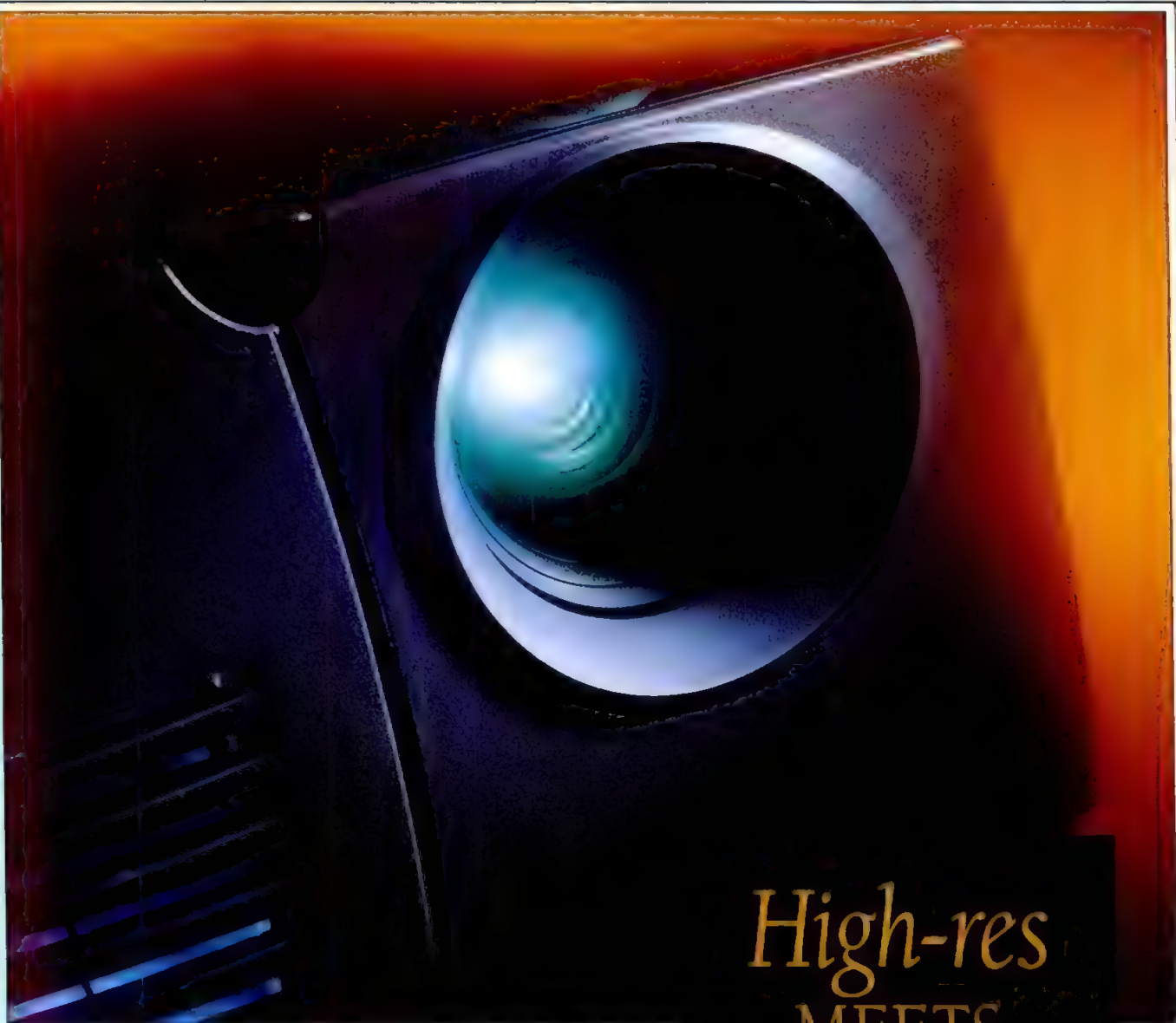
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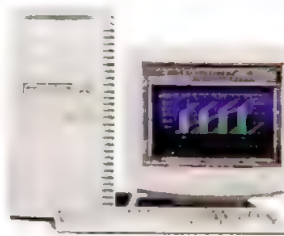
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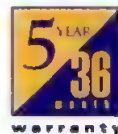
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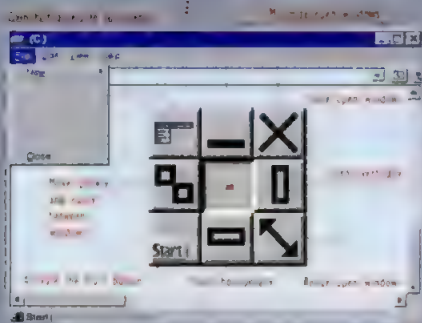
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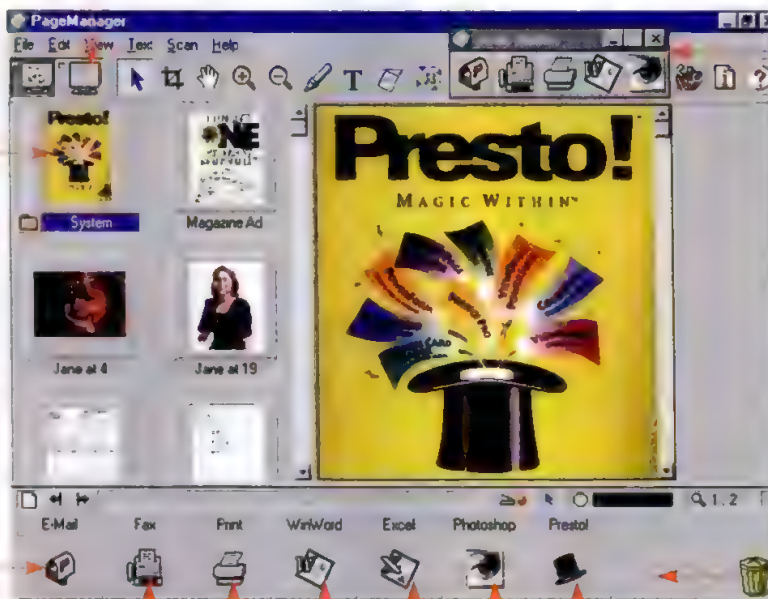
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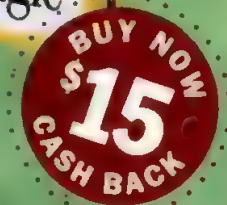
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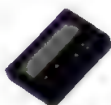
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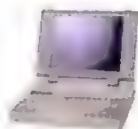
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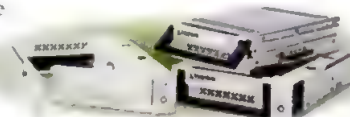


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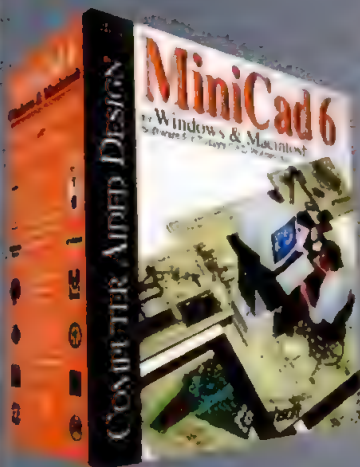


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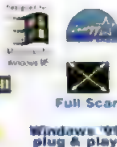
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CAD Suite Advantages

by Tom King.

Want to design your dream home, edit an existing house plan, or hash out a few creative changes on a CAD drawing? Can't afford the expensive software, or would like to start your own design/drafting business? Want dependable software and tools that really work together? Hint: think suite.

The advantages of suites hinges on the extra utilities or other features that make the main programs more productive. A single purchase provides this, plus the ability to correspond with a single software company if support is needed.

Caution! Creating with CAD will strip the very threads of your wallet ... unless you shop around.

The trend moving away from pricey, cumbersome programs, like AutoCAD, has apparently caught on. Take, for instance, a recent CAD suite from ViaGrafix: DesignCAD Office. This suite offers a full featured CAD system

for under a thousand dollars. Say what???

Here's what they give you: DesignCAD 2D and DesignCAD 3D for Windows 95 software (two completely separate programs), cost estimation software, a scanning package, two video tutorials, and thousands of ready-to-use 2D and 3D professional symbols.

Anything helping to save time and boost productivity must be a good deal, right? Be careful, even though there are several combo-packages available, it might be advisable to get references or read the testimonials of actual users.

So, besides my own testimonial, try this one on for size. "I use DesignCAD for my drafting students because it's much easier to learn than AutoCAD," said Bill Stone, technology instructor at Junction City High, Junction City, KS.

The extra tools in DesignCAD



Office 95 include: Professional 2D and 3D symbol libraries (with thousands of pre-made symbols), a cost estimation program (Instant Estimator), a program used to convert

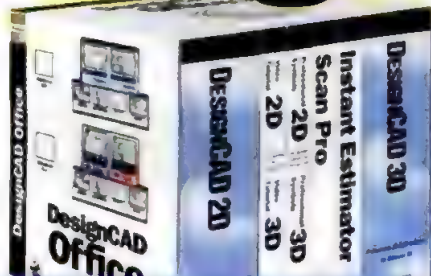
scanned files into CAD drawings (ScanPro), and two complete video tutorials for DesignCAD 2D and 3D. Yes, they even give you manuals and user guides and free technical support. Try it, you'll like it.

ViaGrafix can be reached on the web at viagrafix.com or give them a call at 800/233-3223.

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Tom King hosts the syndicated "CompuTalk - The World's Source For Geek-Free Computer Radio" heard nationwide. Tom is also a computer reporter for CBS's KHOU-TV in Houston, Texas.

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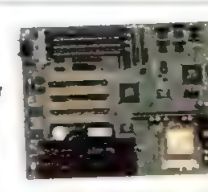


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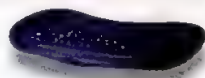
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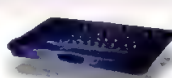
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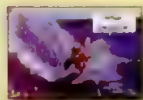
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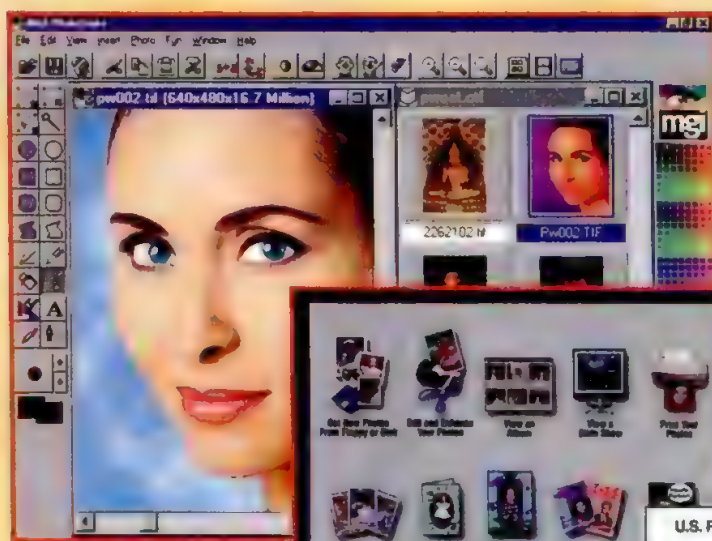
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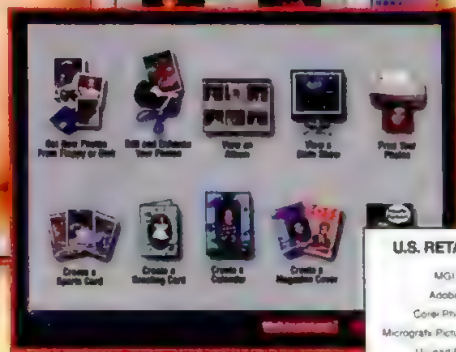
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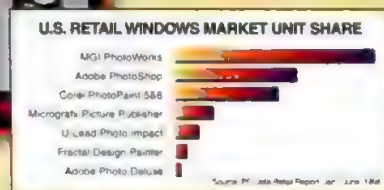
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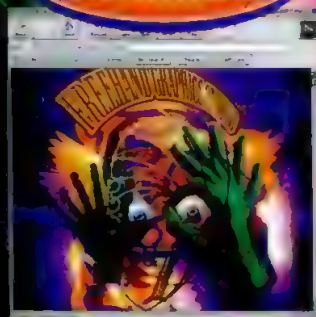
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be surreal so I used Hue Saturation to achieve the green effect. Extreme X (~~color~~) came in handy to model the eyeballs and make them really pop. And voila! My self portrait. Thanks for the great work, Usok. (And trust us, he's much better looking face to face)



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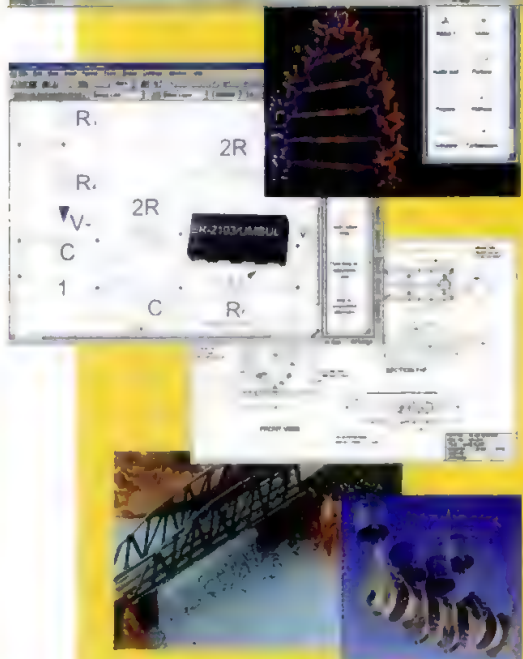
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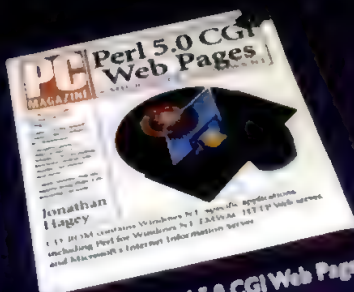
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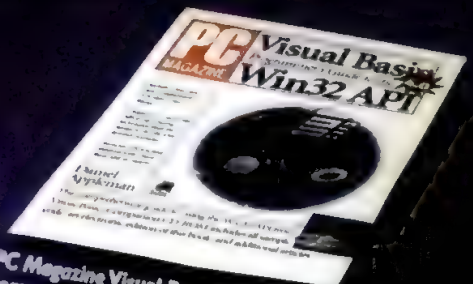
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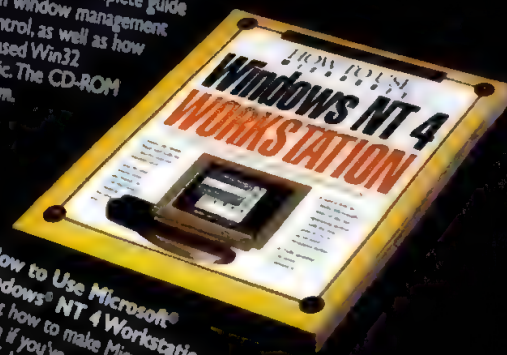
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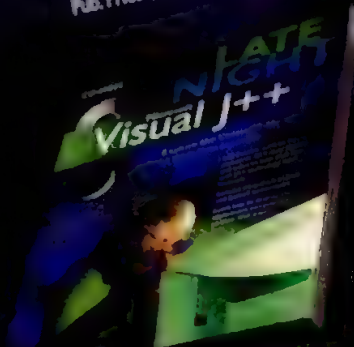
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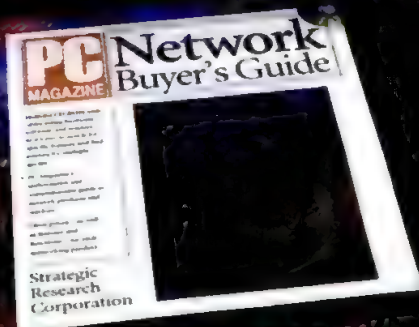
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User-to-User

By Neil J. Rubenking

Consolidating Windows Temporary Files

I use the line `SET TEMP=C:\TEMP` in my `AUTOEXEC.BAT` file, but some programs prefer to put their temp files in the `C:\WINDOWS\TEMP` directory. So in order to clean up my hard disk and remove any old temp files, I need to check both the `C:\TEMP` and the `C:\WINDOWS\TEMP` directories. To make cleanup easier, I wanted to be able to redirect all of the temp files to my `C:\TEMP` directory. Here's my solution:

I added the line

```
SET TMP=C:\TEMP
```

to my `AUTOEXEC.BAT` file. This line sends all the temp files that would normally go to `C:\WINDOWS\TEMP` to the same directory as all the others, making cleanup very easy.

JEFFREY TSUNO
Gardena, California

PC MAGAZINE: Many programs, both DOS- and Windows-based, use temporary files during the course of their operation. Most follow standard usage and store these temporary files in the directory whose name appears in the environment variable `TEMP`. A sizable minority of programs, however, look for the temporary directory in the environment variable named `TMP` instead. If you want to send all temporary files to a particular location—perhaps to a drive that has plenty of space—you need to set both of these variables in your `AUTOEXEC.BAT`.

In theory, every program that creates a temporary file will delete that temporary file before terminating. But in practice, some programs fail to clean up after themselves completely. Power outages and system crashes can also leave orphaned files stuck in the temp directory. Once you've arranged for all temporary files to be dumped in the same location, you can delete any leftovers by adding this line to your `AUTOEXEC.BAT`:

```
DELTree /Y C:\TEMP\*.*
```

Although it's safe to clear out the temp directory during the boot process, if you do it

at any other time you risk deleting a file that's in use by a program.

Avoid Losing Your Icons

Sometimes Windows 3.1 "loses" an icon—usually one for a CD-based program—and substitutes a generic icon instead. While this is easy to fix each time, I wanted a permanent solution. I found it using PC Magazine's IconJack utility. Usually I use IconJack to manage icons that are not already built into Windows or the executable program itself. To fix the problem icons in this case, however, I simply copied each one into IconJack and stored them all in a file called `MYICONS.DLL`. Then, using the Windows File | Properties menu, I changed each icon by browsing and selecting the copy of the same icon from `MYICONS.DLL`. Windows hasn't lost one of these icons since!

WYATT SHANKLE
Huntsville, Alabama

PC MAGAZINE: You might be thinking to yourself, how could Windows "lose" an icon? Every icon can contain several images, differing from one another in size and number of colors. Windows chooses the image most appropriate for your system's display properties. Icon loss most commonly occurs when you change the display's color depth (the number of colors used). After the system restarts, it needs to reread its icons to get the image that best matches the new display properties. If the icon is on a CD-ROM and the CD-ROM isn't in the drive, Windows can "lose" it at this point. (Note that this can happen in Windows 95 and Windows NT as well).

By using IconJack to extract the CD-based icons and store them in a file on the hard disk, you avoid this problem. The icons, in all their variations, are always available, so if Windows needs a new image, it won't have any trouble. Setting up such a system initially may be tedious, as you have to insert every CD-ROM in the drive and extract its icons. But you never need to process a given CD-ROM more than once. Each time you want to add more icons to your `MY-`

HIGHLIGHTS



HARDWARE Don't overlook your Windows program's `READ.ME` files—they can sometimes be quite useful. *Page 292.*



OPERATING ENVIRONMENTS

We've already told you how to get the system date, but now we give you an update that works with DOS 7. *Page 296.*



DATABASES A Microsoft Access function that will skip past week-ends and holidays to give you the next business date. *Page 302.*

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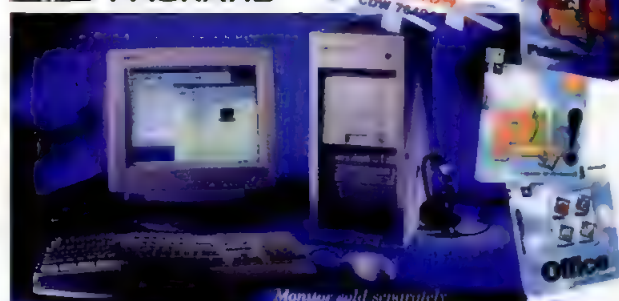
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PC 340

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PC 340

- 166MHz Pentium, 2.5GB hard drive.....

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Aptiva C32.....\$1497.13 CDW 74006

- ✓ 133MHz Pentium, 1.2GB hard drive, 6X CD-ROM drive

Aptiva C33.....\$1699.74 CDW 73083

- ✓ 133MHz Pentium, 1.6GB hard drive, 8X CD-ROM drive

Aptiva C65.....\$2099.00 CDW 73084

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- ✓ Software: Microsoft® Windows 95; Intuit Quicken SE; Lotus® SmartSuite® '96; Groliers Encyclopedia; Mayo Clinic Health Book; Descant 2 (2D) and much more! ✓ 1 year on-site warranty

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- ✓ 8X CD-ROM drive ✓ PCI graphics with 1MB video RAM std. (2MB max.) ✓ 16-bit stereo 3D sound with speakers
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Portege 660CDT

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- ✓ 6X CD-ROM drive
- ✓ 11.3" active-matrix SVGA color display
- ✓ 28.8K bps data/fax modem

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CDW 77243



Satellite Pro 420CDS and 420CDT

- ✓ 100MHz Intel Pentium® processor
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- ✓ Internal 6X CD-ROM drive, swaps with standard 1.44MB floppy drive
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420CDT **\$2868.39** CDW 70246



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- ✓ Integrated 28.8K bps fax/modem

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CDW 70244

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- ✓ 28.8K bps data/fax modem

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Tecra 510

Tecra 500CS and 500CDT

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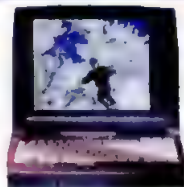


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CDW	71117	68333	68334	71119

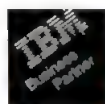
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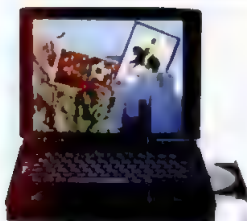
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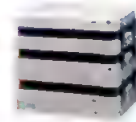
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ICONS.DLL with IconJack, start by loading the existing MYICONS.DLL into IconJack's display. Now load any additional icons, and finish by storing the enlarged collection back to MYICONS.DLL.

Opening Files from the Send To Menu

The MultiLaunch utility described in your issue of May 28, 1996, lets you associate more than one application with a file type. I've been using a less sophisticated technique for opening files with more than one application: the SendTo folder. Just copy any application's shortcut to the SendTo folder. Then when you right-click on any file and choose Send To from its context menu, this application will be part of the list. Just select the desired application and it will launch and open the file.

The only differences between this technique and MultiLaunch are that you can't specify which applications to use with particular extensions, and that you use an extra step when you use Send To menu items. The upside, however, is that you don't need to specify the list of applications for every new file extension. If, like me, you use that feature mostly to open text or configuration files with WordPad or Word 7.0, this method works fine.

ARNAUD GUILLON
Singapore

PC MAGAZINE: To see this technique in action, first launch Explorer and navigate to the SendTo folder. Now right-click the Start menu button and choose Explore. In this second instance of Explorer, open the Programs folder, open the Accessories folder, and locate the shortcut to, say, WordPad. Hold down the Ctrl key and drag this shortcut into the SendTo folder in the first Explorer window. (The Ctrl key tells Windows 95 to make a copy of the shortcut rather than to move it to a new location). And that's it—you're done!

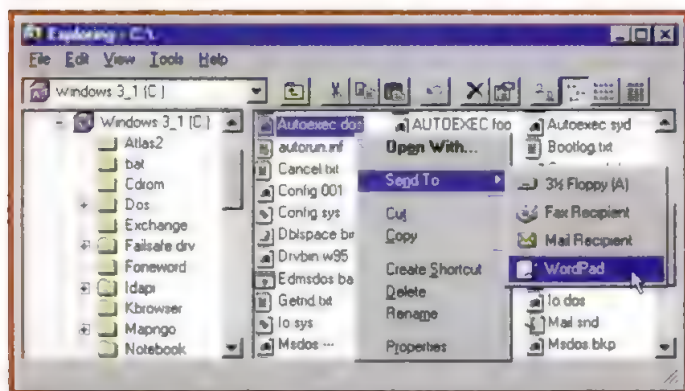


FIGURE 1: Copying a Windows 95 program's shortcut into the SendTo folder makes it accessible from every file's Send To menu.

Right-click on any nonexecutable file, select Send To, and choose the new WordPad shortcut. This is most useful when the file is a text file with a nonstandard extension, such as Autoexec.dos (Figure 1). Even binary files, however, can be loaded into WordPad for examination—perhaps to look for a copyright notice or for another particular embedded string of characters. If you exercise extreme care, you can even edit binary files in WordPad. To do so, you must make sure always to replace characters, never to insert or delete them. And, of course, don't forget to back up the file before editing.

A Better Batch File Windows Detector

The User-to-User column of March 26, 1996, demonstrated a technique that lets a batch file determine whether it is running in a DOS box under Windows 3.x or Windows 95, or just under DOS. The technique, which works by determining whether the environment contains a variable whose name is windir (all lowercase), is quite complex, and uses several temporary files. Here is a much easier way:

```
set windir=
if not '%windir%'=='' echo Windows
```

If a user-created environment variable named WINDIR (all uppercase) exists, the first line wipes it out. If the Windows-created variable named windir is still present, then the batch file is running under Windows.

GARY B. GORDON
Snohomish,
Washington

PC MAGAZINE: Both batch file tests are based on the fact that Windows creates an environment variable whose name is windir (lowercase). Upper- and lowercase are distinguished in environment variable values, but when the DOS SET command creates an environ-

```
@ECHO OFF
IF '%OS%'=='Windows_NT' GOTO Done
SET windir=
SET winbootdir=
IF '%windir%'=='' SET OS=DOS
IF '%OS%'==' ' IF '%winbootdir%'=='' SET OS=Windows_3.x
IF '%OS%'=='' SET OS=Windows_95
:Done
ECHO Operating system is %OS%
```

FIGURE 2: This batch file doesn't require any temporary files to determine whether it's running under DOS, Windows 3.x, Windows 95, or Windows NT.

ment variable, it always converts the variable name to uppercase. Thus, there is no way to change or delete the windir variable using ordinary DOS commands.

The earlier, more complex test piped the output of the SET command through the FIND filter, seeking the string windir=. FIND is case-sensitive by default, so only the lowercase version matched. The existence or nonexistence of a user-defined variable named WINDIR was irrelevant to this test.

The new test starts by clearing the windir variable. But because variable names are converted to uppercase by the SET command, the Windows-created windir variable is not affected. A user-created WINDIR variable will be erased, if present. After that step, a non-empty value in the windir variable is a sure indication that Windows is running.

Detecting Windows NT is a bit more difficult, as the SET command in a Windows NT command prompt does not force variable names to become uppercase. Under this OS, it is possible to delete or modify system-created environment variables. An attempt to delete the windir variable under Windows NT would succeed, so a different test is required. Batch files can assume Windows NT is the active operating system if they find an environment variable named OS with the value Windows_NT.

The batch file in Figure 2 checks for the presence of the OS=Windows_NT variable and jumps to the end if it's found. If Windows NT is not the OS, then it's safe to try deleting the windir and winbootdir variables. Again, this will affect only user-created variables, not those created by Windows 3.x or Windows 95. If the windir variable is empty, the operating system is DOS. Otherwise, if the winbootdir variable is empty, the OS is Windows 3.x. If both of those variables are non-empty, the OS is Windows 95.

This batch file creates a variable named OS with value DOS, Windows_3.x, or Windows_95, paralleling the system-set value Windows_NT. You can CALL it from another batch file and test the value of the OS variable. If you do use it this way, you'll probably want to delete the final ECHO line.

Ask Our Advisors

HARDWARE

Printing Problem Under Windows 95



Since I switched to Windows 95, I've had problems printing to my HP LaserJet 4P. Print jobs end before they're finished and the printer's LCD message window displays a "21 PRINT OVERRUN" error. I've tried many different print settings, including lower graphics resolution, but the problem persists. The printer has 2MB of memory, which should be sufficient. Can you recommend a solution?

ANNE AMES
via the Internet

PC MAGAZINE: The fix comes straight from Microsoft and, in fact, is included on the Windows 95 CD-ROM. Most users don't bother to look at the READ.ME files that accompany many programs, but Windows' text files are actually quite useful. In this case, help for your problem comes from the PRINTER.TXT file.

This file contains a section on troubleshooting HP LaserJet printing problems.

Within that section is one with the heading "Error 21—Print Overrun." The recommendation here is that you try turning on the printer's Page Protection feature. With some LaserJet models, you do this using the front panel controls. For other models, an item for this feature appears on the Device Options tab of the printer's Properties screen.

The Page Protection feature works by reserving additional printer memory for formatting page images. Pages that contain lots of complex formatting (not only graphics but multiple fonts and a complicated layout) can result in more data than the default page buffer can hold. Reserving more memory for the page buffer means less will be available for downloadable fonts and printer macros but improves the odds that complex pages will print completely.

If enabling the Page Protection feature doesn't solve the problem, the PRINTER.TXT file then recommends you choose Raster mode instead of Vector mode on the Graphics tab of the printer driver.

Two other adjustments not described in PRINTER.TXT may also help: On the Detail tab of the printer Properties screen, choose

the Spool Settings button, and set the Spool Data Format to RAW. And on the Device Options tab, move the Printer Memory Tracking slider to the Aggressive setting.—Alfred Poor

Old-Fashioned Format

I recently tried to perform a low-level format on a SCSI disk attached to my PCI SCSI adapter. When I used the DEBUG command G=000C8000:6, the system locked up. I tried again using ...:7—with the same result. I then took out the PCI adapter and replaced it with an older ISA SCSI adapter. This time, the command succeeded in formatting the disk. Why didn't it work with the PCI adapter?

CLIFTON WISDOM
East Brunswick, New Jersey

PC MAGAZINE: First, remember that hard disks rarely need a low-level format, and that you should never try to low-level format an IDE drive unless you're certain you're using the correct utility for the operation. (You can permanently ruin some IDE drives by attempting to low-level format them.) It's actually a little surprising that the DEBUG command worked at all. This procedure is a hold-over from the IBM XT days, when the Western Digital hard disk controllers contained their own programs in

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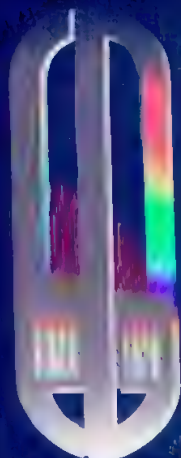
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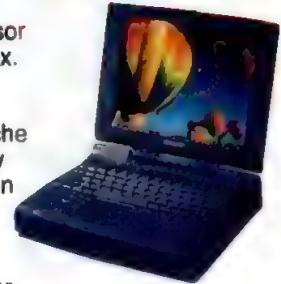
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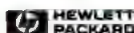
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ROM, including a low-level format utility. The DEBUG G command causes a program located at the specified memory address to be executed. The address for the XT controller was C800, though some cards used CA00, CC00, or CE00.

Starting with the IBM AT, the low-level format was handled by utilities, either in the computer's ROM or on disk, in the form of a setup or diagnostic utility. Most modern SCSI controllers come with their own separate low-level format utility. If you need to low-level format a SCSI disk, first check the software that came with your controller for an appropriate utility.—*Alfred Poor*

OPERATING ENVIRONMENTS

Installing Applications On a Dual-Boot System



I have my brand-new PC configured for dual booting. I can choose whether to run Windows NT or Windows 95 at boot time. But I'm wondering if I can configure my applications for use in both environments. In other words, I want to install only one version of Excel, Netscape Navigator, Quicken, and so forth on my hard disk so I can use the same applications regardless of whether I'm running Windows 95 or Windows NT.

JON COHEN
via the Internet

PC MAGAZINE: The problem here is that each application's setup program needs to initialize the Registry in both Windows 95 and Windows NT. It's not enough, as you've probably noticed, simply to locate the .EXE file and create an icon or shortcut for it. My own solution is to perform the installation twice: once in Windows 95 and once in Windows NT, using the same location for each. Each installation updates the appropriate Registry; the second installation pointlessly but harmlessly overwrites the files from the first. Until Windows 95 and Windows NT converge sufficiently for them to share the same Registry, this kind of double installation will continue to be necessary.—*Neil J. Rubenking*

Adding a Device Driver In OS/2 Warp 4.0

My CD-ROM drive isn't directly supported by OS/2 Warp, but the vendor was able to supply an OS/2 device driver. With Warp 3.0, I was able to add the driver to the installation disks and to my CONFIG.SYS file, and everything worked fine. With Warp 4.0, however, the installation proceeds halfway and then tells me it can't find the CD-ROM drive. Do I need a new device driver?

HENRY MATTHIAS
Wilmington, Delaware

PC MAGAZINE: No, you don't need a new driver. You've discovered a by-product of IBM's effort to smooth installation. With OS/2 Warp, Version 3.0, you would load the installation program from the setup disk, then you would be prompted for disk 1 and more files would be copied. After this, a lot of files would be copied from the CD-ROM, and the setup program would prompt you to put the installation disk back in—and, sometimes, disk 1, too.

Users complained to IBM about this annoying, multiple reinsertion procedure, so the process was changed for Warp 4.0. After the initial pass through the installation disk, disk 1, and disk 2, the needed files are copied from CD-ROM as in the earlier version. But instead of having to re-access files from the disks, the installation routine gets the information from images of the disks on the CD-ROM rather than asking for the physical disks. This is a nice improvement for those users whose hardware is supported in the base product, but introduces a problem for people like you.

As you found with Warp 3.0, you have to update the disks in order to load your extra device driver. How you do this in Version 4.0 depends on the driver itself. If the instructions from the vendor tell you that the driver is loaded through a basedev= statement in CONFIG.SYS, you must copy the device driver to disk 1. If the driver is loaded through a device= statement, you must copy the device driver to disk 2. As with Version 3.0, you must also update the CONFIG.SYS file on the installation disk to include the basedev= or device= statement.

In Version 3.0, the CONFIG.SYS file from the disk was copied to your disk and was used to create the final OS/2 configuration file. But because the disks aren't re-accessed in Version 4.0, the configuration file is based on the CONFIG.SYS file on the CD-ROM—which you obviously can't change. That's why OS/2 isn't finding your device driver after the system is booted when you're only a short way into the installation. Fortunately, IBM has created a new instruction you can add to the CONFIG.SYS files on your disks:

```
SET COPYFROMFLOPPY=1
```

This tells the installation program that it must copy your additional device driver and updated CONFIG.SYS from disk.—*Brian Proffit*

Get the System Date, Even Under DOS 7

We are a huge site running HP3000 on an X25 network that links all our branches kingdom-wide. We also have four Novell servers running. Every day, a file is created on one of our

```
@ECHO OFF
IF NOT '%2'=='' GOTO SecondTime
ECHO @PROMPT %0 $d > T$ESM$P1.BAT
REM DO NOT substitute CALL for COMMAND /C
REM in next line
COMMAND /C T$ESM$P1.BAT > T$ESM$P2.BAT
T$ESM$P2.BAT
:— SecondTime —
DEL T$ESM$P?.BAT
SET Date=%2
```

FIGURE 1: In DOS 7 or earlier versions, this batch file puts the current date into an environment variable named Date.

servers by an overnight process. Before the file gets overwritten the next day, a batch file has to move it to a different directory with a filename that contains the current date—for example, TRAN0429. How can I get a DOS variable that returns the current date?

ROBERT FARRO
Jeddah, Saudi Arabia

PC MAGAZINE: What you're asking is not merely to get the date into an environment variable, but to extract the month, day, and year into separate variables. We've answered this question before, but the old solution fails under DOS 7, the version associated with Windows 95. Thus, a dual solution is required.

The GETDATE batch file in Figure 1 handles putting the date into a variable, regardless of DOS version. MMDD.BAT (available online), which illustrates the old solution, relies on a quirk of the FOR command to split the date into month, day, and year. DOS 7 eliminated the FOR command quirk, so DOS 7 users need a completely different batch file, MMDD95.BAT, shown in Figure 2.

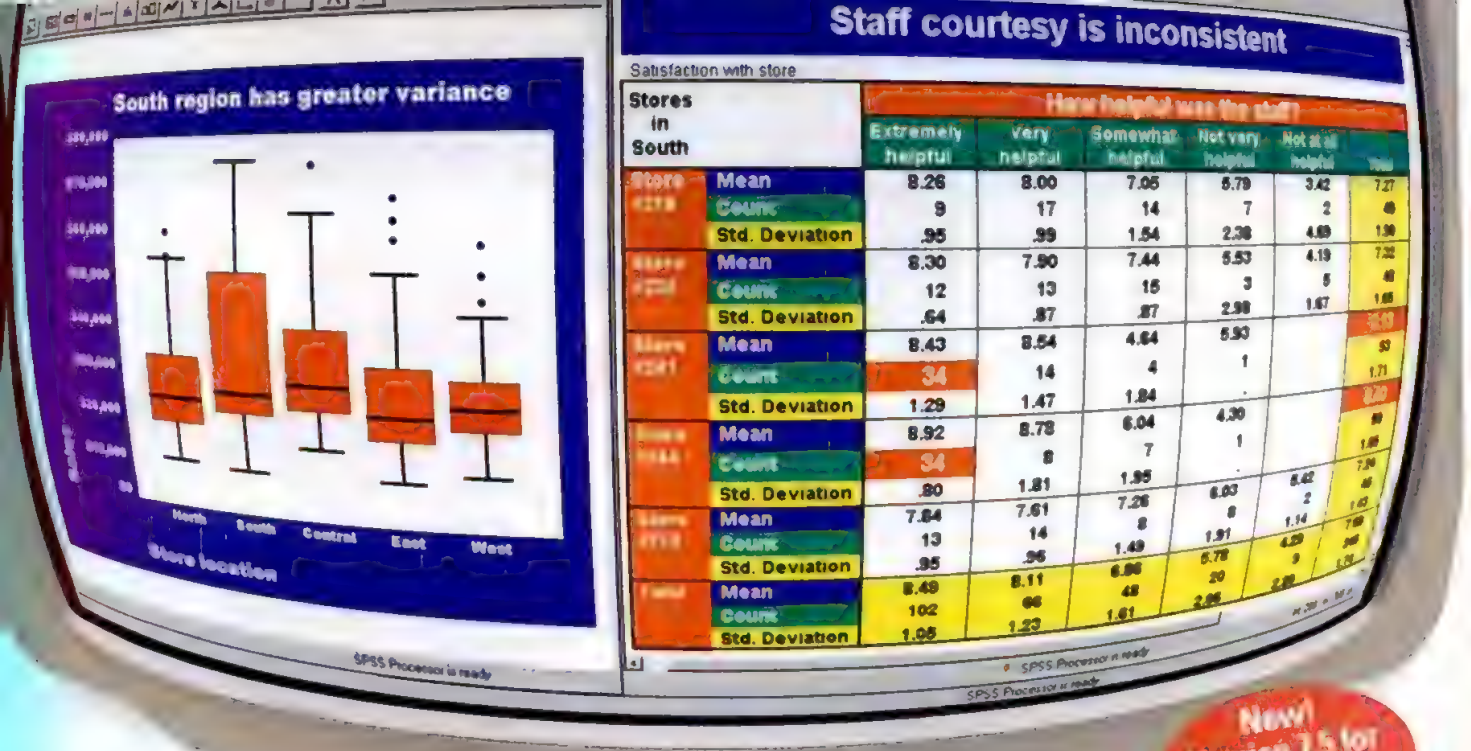
MMDD95.BAT uses the CHOICE command to split the date into individual characters and then to assemble those characters into month, day, and year. Normally, CHOICE is used to present the user with a prompt and a series of possible one-character responses. When the user presses a character from the list, CHOICE terminates and sets the DOS ERRORLEVEL to the position of that character on the list.

The normal usage of choice is irrelevant in MMDD95.BAT; the user's input is simulated using redirection, and the ERRORLEVEL is ignored. What's important is the way CHOICE formats its prompt and character list. The prompt comes first, followed by the list of characters, separated by commas and enclosed in square brackets, with a question mark at the end.

Stripped of its redirection commands, the CHOICE line in MMDD95 reads:

```
CHOICE /S/C:%date%: %0
```

The %date% string is replaced by the value of



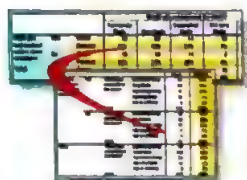
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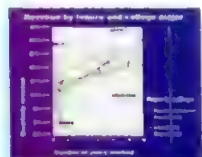
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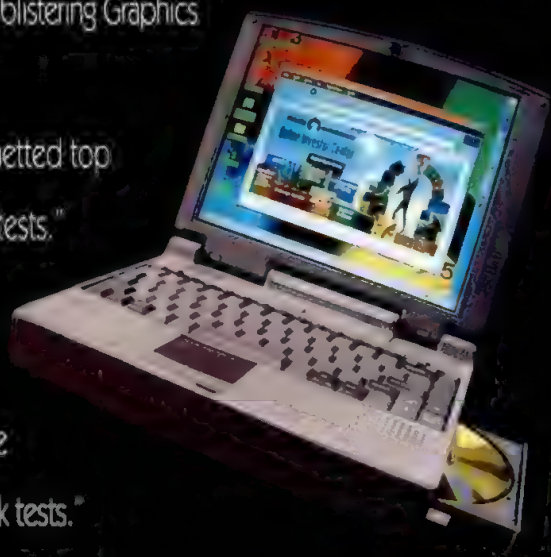
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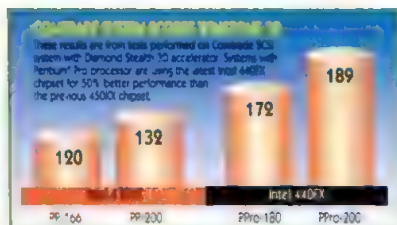
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A1542C, Bare, ISA, Floppy, Bus Master	\$200
A1542CKIT, ISA, Floppy, Bus Master	\$249
A2920KIT, PCI, PIO	\$159
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A2940, Bare, PCI, Bus Master	\$199
A2940KIT, PCI, Bus Master	\$259
A2940WKIT, PCI, Wide SCSI, Bus Master	\$299
A2940MUW, PCI, Wide SCSI, for Macintosh	\$325
A3940KIT, PCI, Twin Channel, Bus Master	\$419
A3940WKIT, PCI, Wide, Twin Channel, Bus Master	\$519
A3985KIT, PCI, RAID, Bus Master	\$719
A3985WKIT, PCI, Wide, RAID, Bus Master	\$819
A2842VLKIT, VESA, Floppy, Bus Master	\$239
A2825VLKIT, EIDE, SCSI, floppy	\$135

• MEDIA •

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TR3	\$34	\$29	\$27
TR4	\$41	\$36	\$34
QW3080	\$32	\$27	\$25
4mm 90M	\$15	\$10	\$8
4mm 120M	\$27	\$22	\$20
8mm 112M	\$15	\$10	\$8
8mm 160M	\$23	\$18	\$16
DLT 3	\$52	\$49	\$45
DLT 4	\$105	\$99	\$92

OPTICAL DISKS

230MB	[TJ230]	\$21	\$16	\$14
650MB 1024K	[TJ650]	\$45	\$41	\$39
1.3GB 1024K	[TJ1.3]	\$51	\$47	\$45
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88MB	[SQ800]	\$48	\$44	\$42
135MB	[EZDISK]	\$26	\$22	\$20
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270MB	[SQ327]	\$58	\$54	\$52

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44MB	[N450U]	\$34	\$30	\$28
88MB	[N900U]	\$38	\$34	\$32
200MB	[N200U]	\$62	\$58	\$56
270MB	[N270U]	\$52	\$48	\$46

IOMEGA

100MB ZIP	[ZIP100C]	\$23	\$18	\$16
1Gig IAZ	[IAZC-1GIG]	\$99	\$95	\$93

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All Optical Drive prices below include 1 FREE cartridge. Except Toray.

230MB	Fujitsu IDE	\$339
230MB	Smart Storage Solutions SCSI	\$339
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640MB	Fujitsu (230MB backwards compatible)	\$555
650MB	Toray 4xCD and 640MB Optical comb.	\$499
2.6Gig	Smart Storage Solutions	\$1649
2.6Gig	Maxoptix	\$1599
2.6Gig	Hewlett Packard	\$2125
52Gig	Maxoptix (does not include free disks)	\$4549

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Internal SCSI/External SCSI	\$269/\$339
1.3Gig 1 free disk Internal SCSI/External SCSI	\$399/\$499
100MB Zip	
External SCSI with 1 disk/Ext Parallel with 1 disk	\$189/\$189
1 GB Jaz	
Internal SCSI with 1 disk/Ext SCSI with 1 disk	\$379/\$469

• CD RECORDERS •

Order from our Build Your Own Kit feature on the previous page, or choose one of these COMPLETE KITS which includes drive, controller, software, and 1 recordable CD disk. Smart Storage Solutions kit includes 5 FREE recordable CD disks!

Smart Storage Solutions	2X Write 4X Read	\$499
HP	2X Write 4X Read	\$569
Smart & Friendly	2X Write 4X Read	\$529
Teac	4X Write 4X Read	\$829
Smart Storage Solutions	4X Write 4X Read	\$889
Yamaha	4X Write 4X Read	\$819

• CD ROM DRIVES •

SCSI

Brand	Spin	Model	Speed	Int	Ext
NEC	4X	CDR222	200ms	\$99	\$189
Plexor	6X	PX63CS	145ms	\$269	\$359
Philips	8X	PC80S	195ms	\$205	\$295
NEC	8X	CDR1410	145ms	\$205	\$295
Plexor	8X	PX83CS	115ms	\$299	\$389
Pioneer	10X	DRU10XSCSI	140ms	\$225	\$315
Plexor	12X	PX12TS	105ms	\$319	\$409
Plexor	12X	PX12CS	105ms	\$349	\$439

ATAPI IDE

Brand	Spin	Model	Speed	Int	Ext
NEC	8X	CDR1400	140ms	\$110	\$140
Mitsumi	8X	CRMCFX800	150ms	\$110	\$140
Acer	10X	AC910A	150ms	\$125	\$155
Pioneer	10X	DRA10X	140ms	\$135	\$165
Lite On	12X	LTN126A	155ms	\$129	\$159
Acer	12X	AC612A	125ms	\$149	\$179
Mitsumi	12X	CRMCFX12X	150ms	\$175	\$205

IDE CD ROM CHANGER

NEC	4X	CDR4X4	4Disk	250ms	\$99
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SCSI CD ROM CHANGERS

Nakamichi	8X	MJ48S	4Disk	150ms	\$399
Pioneer	4.4X	DRM-624X	6 Disk	190ms	\$379

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Includes DOS/Win backup software and 1 free tape.

800MB	Seagate	TST800R	\$119
1.7Gig	Seagate	TSM1700	\$199
3.2Gig	Seagate	TST3200RFT	\$215

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Includes DOS/Win backup software and 1 free tape.

800MB	Seagate	TST800RPT	\$235
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IDE or SCSI TRAVAN (SAVE \$10 with hard drive purchase)

Includes DOS/Win backup software and 1 free tape.

4-8GB	Seagate	TST8000(A)	\$379
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SCSI 4mm DAT

2GB	Hewlett Packard	C1534	\$609
2-4GB	Seagate	C4324RP	\$679
2-4GB	Hewlett Packard	C1536	\$699
4-8GB	Sony	SDT5000	\$809
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32-64GB	Sony	TSL7000 8 tape autoloader	\$2199
48-96GB	Seagate	C4586NP 12 tape autoloader	\$2399

SCSI 8mm DAT

3.5-7GB	Exabyte	EXB8205XL	\$1269
7-14GB	Exabyte	EXB8505XL	\$1889
7-14GB	Exabyte	EXB8700LT	\$1089
20-40GB	Exabyte	EXB8900	\$5499
70-140GB	Exabyte	EXB10H 10 tape autoloader	\$5439

SCSI DLT 20-40GB Quantum DLT4000 \$4699

BACKUP SOFTWARE (SAVE \$10 with hard drive purchase)

NovaStor's NovaBack CD contains software for DOS, Win 3.1, Win 95, OS/2, Warp, and Macintosh	\$79
NovaStor's NovaDisk CD contains software to backup to disk drives and removables	\$79
Seagate Arcada for Windows NT (call for network version) workstation/single server/enterprise	\$239/499/869
TAPEDISK, allows DAT drive to be used as hard drive under DOS/Win 3.1, Win 95	\$189

• IDE HARD DRIVES •

IDE	Speed	RPM	Brand	Model	Wty	Price
540MB	14ms	3600	Seagate	ST3541A	3	\$139
631MB	14ms	3600	Seagate	ST3630A	3	\$145
850MB	10ms	4500	Western Digital	AC2850	3	\$165
850MB	14ms	3600	Seagate	ST3851A	3	\$155
1200MB	10ms	5400	Fujitsu	M1636T	3	\$195
1275MB	12ms	4500	Seagate	ST31276A	3	\$189
1280MB	11ms	4500	Quantum	TM31280A	3	\$195
1281MB	11ms	5200	Western Digital	AC21200A	3	\$199
1330MB	12ms	4480	Maxtor	M71336A	3	\$195
1623MB	14ms	3600	Seagate	ST31621A	3	\$212
1624MB	10ms	5200	Western Digital	AC21600	3	\$219
1670MB	11ms	4480	Maxtor	M71670A	3	\$215
1700MB	10ms	5400	Fujitsu	M1623T	3	\$215
1700MB	12ms	4500	Seagate	ST31720A	3	\$215
1700MB	11ms	4500	Quantum	SR31700A	3	\$219
2004MB	11ms	4480	Maxtor	M72004A	3	\$255
2100MB	11ms	5200	Western Digital	AC22100	3	\$265
2100MB	9ms	5400	Fujitsu	M1624T	3	\$249
2132MB	12.5ms	4500	Seagate	ST32132A	3	\$270
2168MB	10.5ms	4500	Quantum	TM32160A	3	\$259
2500MB	9ms	5400	Fujitsu	M1638T	3	\$259
2550MB	15ms	3600	Quantum	BF2500A	3	\$242
2559MB	11ms	5200	Western Digital	AC32500	3	\$275
2560MB	11ms	5400	Seagate	ST5250A	3	\$292
2700MB	12ms	4480	Maxtor	M72700A	3	\$305
3166MB	12ms	5200	Western Digital	AC33100	3	\$325
3254MB	10.5ms	4500	Quantum	TM33200A	3	\$325
3500MB	12ms	4480	Maxtor	M83500A	3	\$419
3840MB	10.5ms	4500	Quantum	TM33840A	3	\$389

• SCSI HARD DRIVES •

SCSI	Speed	RPM	Brand	Model	Wty	Int	Ext
1050MB	9ms	5400	Seagate	ST31055N	3	\$349	\$409
1280MB	12ms	4500	Quantum	TM31280S	3	\$279	\$339
2110MB	10.5ms	4500	Quantum	TM32110S	3	\$375	\$435
2147MB	9ms	5400	Seagate	ST32155N	5	\$485	\$545
2147MB	8ms	7200	Seagate	ST32550N	5	\$729	\$789
2150MB	9ms	5400	Seagate	ST32155N	5	\$479	\$539
2150MB	8ms	7200	Seagate	ST32171N	5	\$739	\$799
3254MB	10.5ms	4500	Quantum	TM33200S	3	\$449	\$509
4290MB	8ms	7200	Seagate	ST15230N	5	\$885	\$945
4350MB	8ms	7200	Seagate	ST34371N	5	\$1145	\$1205
4400MB	8ms	7200	Fujitsu	M2954S	5	\$819	\$879
4550MB	8ms	7200	Quantum	XP34550S	5	\$999	\$1059
9080MB	11ms	5400	Seagate	ST410800N	5	\$1779	\$1879
9100MB	9ms	7200	Seagate	ST19171N	5	\$2085	\$2145
9100MB	8ms	7200	Quantum	XP3900S	5	\$1599	\$1659

WIDE SCSI

1050MB	9ms	5400	Seagate	ST31055W	5	\$379	\$509
2050MB	8.5ms	7200	Micropolis	MC4221	5	\$545	\$599
2050MB	8.5ms	7200	Micropolis	MC4221AV	5	\$600	\$660
2147MB	9ms	5400	Micropolis	MC4421	5	\$379	\$439
2147MB	9ms	5400	Micropolis	MC4421AV	5	\$459	\$519
2150MB	9ms	5400	Seagate	ST32155W	5	\$529	\$659
2150MB	8ms	7200	Seagate	ST32171W	5	\$779	\$909
4294MB	8ms	7200	Micropolis	MC3243	5	\$829	\$889
4294MB	8ms	7200	Micropolis	MC3243AV	5	\$829	\$945
4294MB	8ms	7200	Micropolis	MC3243W	5	\$929	\$1059
4294MB	8ms	7200	Micropolis	MC3243WD	5	\$899	\$1029
4294MB	8ms	7200	Micropolis	MC3243WAV	5	\$999	\$1139
4350MB	8ms	7200	Seagate	ST34371W	5	\$1189	\$1379
4550MB	8ms	7200	Quantum	XP34550W	5	\$999	\$1059
4550MB	7.9ms	7200	Micropolis	MC4345	5	\$999	\$1059
4550MB	7.9ms	7200	Micropolis	MC4345W	5	\$1020	\$1130
9091MB	8.5ms	7200	Micropolis	MC3391	5	\$1799	\$1859
9091MB	8.5ms	7200	Micropolis	MC3391W	5	\$1709	\$1849
9100MB	11ms	5400	Seagate	ST410800W	5	\$2029	\$2219
9100MB	9ms	7200	Seagate	ST19171W	5	\$2149	\$2279
9100MB	12ms	5400	Micropolis	MC1991	5	\$1599	\$1699
9100MB	12ms	5400	Micropolis	MC1991AV	5	\$1699	\$1799
9100MB	12ms	5400	Micropolis	MC1991W	5	\$1699	\$1889
9100MB	12ms	5400	Micropolis	MC1991WAV	5	\$1839	\$2029
9100MB	8ms	7200	Quantum	XP3900W	5	\$1599	\$1659



the date environment variable, and %0 is replaced by the name of the batch file itself. The resulting prompt is redirected to a temporary batch file and looks something like this:

```
MMDD95 [ :.0.4.-.2.9.-.1.9.9.6.: ]?
```

When the temporary batch file is executed, it in turn executes MMDD95.BAT, passing it the split-up date.

The comma and semicolon both serve to separate command line parameters, so this time MMDD95 gets each character of the date as a separate command line parameter, preceded by [and followed by]. Now it's easy to reassemble the digits into separate month, day, and year variables.

Both MMDD.BAT and MMDD95.BAT will require some adjustment for non-U.S. date formats. In MMDD95.BAT, each occurrence of "-" must be replaced with the actual date separator. MMDD.BAT ignores the date separator, but it assumes that the first two date elements are two digits in length. In either batch file, if the order of date elements is not month/day/year, then the order in which the variables are filled will have to be changed. Still, modifying these batch files for use with different date formats will be no great task.

—Neil J. Rubenking

```
@ECHO OFF
REM Assumes date separator is "-".
IF NOT '%1'=='' GOTO Process
CALL GETDATE
ECHO:; |CHOICE/S/C:%date%; %0
ECHO>MMDD95$.BAT
MMDD95$.BAT
:Process
DEL MMDD95$.BAT
SET Month=
SET Day=
SET Year=
SET Which=Month
:Loop
SHIFT
IF '%1'==']?' GOTO OutOfLoop
IF '%1'=='' GOTO OutOfLoop
IF '%1'=='-' IF '%Which%'=='Day'
=>SET Which=Year
IF '%1'=='-' IF '%Which%'=='Month' SET
Which=Day
IF '%1'=='-' GOTO Loop
IF '%Which%'=='Month' SET Month=%Month%%1
IF '%Which%'=='Day' SET Day=%Day%%1
IF '%Which%'=='Year' SET Year=%Year%%1
GOTO Loop
:OutOfLoop
ECHO Date is "%Date%"
ECHO Month is "%Month%", Day is "%Day%",
ECHO Year is "%Year%"
```

FIGURE 2: This batch file puts the current month, day, and year into environment variables.

WORD PROCESSING

Moving Text Without Cutting and Pasting



While working with Microsoft Write, I found a new way to move text. If you select some text, you can copy or move that block with a click of the mouse. To copy the selected text, move the mouse pointer to the position to which you want to move the text, then hold down the Alt key as you click. To move the text, hold down the Alt and Shift keys as you click.

Curiously, this approach doesn't seem to use the clipboard to cut or copy and then paste the text. Can you explain how this is done?

DAN GABBARD
via CompuServe

PC MAGAZINE: You're right that this technique doesn't use the clipboard. You can prove this easily enough by first copying text to the clipboard, moving some other text with this technique, and then inserting the text from the clipboard. You'll find that the text you copied to the clipboard earlier gets inserted, which means it hasn't been displaced by the text you moved using the mouse. Similar techniques exist in Corel WordPerfect, Lotus Word Pro, and Microsoft Word, which I'll get to in a moment. Whichever word processor you prefer, this trick can come in handy when you need to move or copy some text but already have something stored on the clipboard you don't want to wipe out.

Bypassing the clipboard is surprising only in terms of the cut-and-paste model. Cutting (or copying) and pasting takes two steps, something that shows most clearly when you cut and paste. When you give the command to cut, the text disappears from the document, which means it has to be put in a holding area before it is pasted. What Write is doing when you use the mouse command, however, is moving the text directly without needing a holding area in between. The text stays at its original position until you tell Write where to move it.

You can think of this approach—moving text in one step instead of cutting or copying in one step and then pasting in another—as a mouse-based variation of the old WordStar Move and Copy commands. In WordStar, you'd select a block of text, then either move or copy the block. Even if you were moving it, the text would stay at its original position until you specified the destination.

If you don't remember WordStar, you may prefer to think of the move feature in

Write as a precursor to using the mouse to drag and drop, a feature found in current versions of Word, WordPerfect, and Word Pro. In all three programs, you can move text by dragging and dropping, or copy text by holding the Ctrl key down as you drag and drop. But in all three programs, even when you're moving (rather than copying), the original text stays put until you tell the program to drop it at a new location. (Note that you can hit Esc to cancel the move before you complete the operation.)

Word users should note that in addition to the standard Windows cut-and-paste commands, Word 6.0 and Word 7.0 offer a little-known keyboard command for moving text in one step: First select the text using the keyboard or mouse. Then hit F2 and move the insertion point—which will now be a vertical gray line—to the new position. You can either use the arrow keys to move the cursor or you can click once with the mouse. Finally, hit Enter to move the text, or hit Esc to cancel the move. As with the other techniques discussed here, this will move the text without overwriting whatever is on the clipboard.

Finally, note that Windows 95 replaces Write with Notepad and WordPad. Neither of these programs will let you move or copy text the same way as Write does, but WordPad will let you drag and drop to move or copy text.

—M. David Stone

DATABASES

Business Date Calculations



I need help writing a function in Access that will take a date entered by a user, add a set number of days to it, adjust the result forward to a Monday if the calculated date falls on a weekend, and also adjust the result forward if the calculated date falls on particular holidays that have been pre-defined in a table. Can you help?

MICHAEL JONES
Anchorage, Alaska

PC MAGAZINE: The code in Figure 3 should help. The BdayAdd function works by adding the number of days to the start date, then skipping past weekends (Saturdays and Sundays) and holidays. To do this, BdayAdd calls the IsWeekend and IsHoliday functions to determine if a date occurs on a weekend or is a holiday, according to the Holidays table.

The IsWeekend function returns true if the passed date is either a Saturday or Sunday. It works by using the DatePart function to return the weekday number for the passed date. Because DatePart returns a value of 1 for Sunday and 7 for Saturday, we can test for those values to determine if the date occurs on a weekend, as follows:



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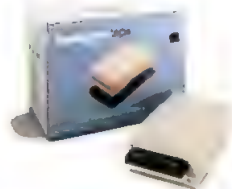
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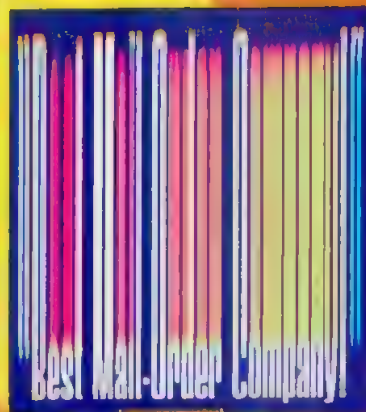
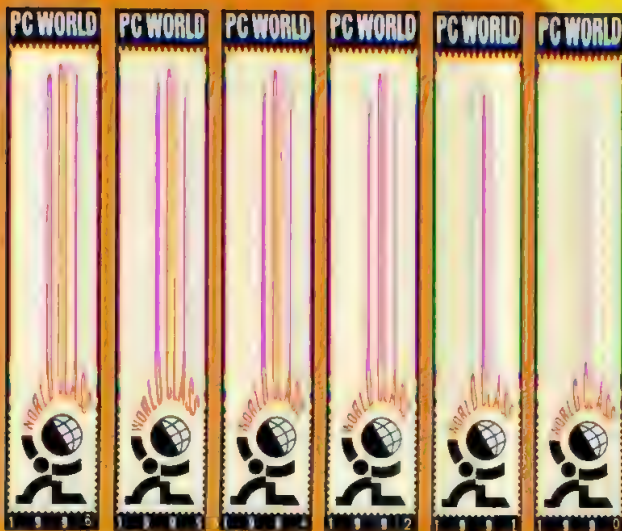
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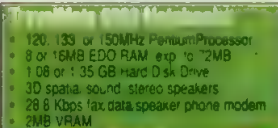
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- $\mathbb{R}^n$ and $\mathbb{R}^m$ are vector spaces over $\mathbb{R}$ and $\mathbb{C}$ respectively.

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1. *Journal of the American Medical Association*, 1997; 277: 1039-1043.

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```

*****
' Function BdayAdd(datStart, intDays) Microsoft Access
' Add intDays days to datStart, making
' sure the resulting date is a
' working business day, excluding weekends
' and holidays listed in the holidays table.
*****
Public Function BdayAdd(datStart As Date, intDays As
Integer) As Date
Dim datEnd As Date
' Start by adding the number of days to the startdate
datEnd = DateAdd("d", datStart, intDays)
' Eliminate weekends and holidays
While IsWeekend(datEnd) Or IsHoliday(datEnd)
    datEnd = DateAdd("d", datEnd, 1) ' Move forward one
Wend
BdayAdd = datEnd ' Assign result for return value

End Function

*****
' Function IsWeekend(AnyDate As Date) Microsoft Access
' Returns True if Date is a Saturday or Sunday
*****

```

```

Public Function IsWeekend(AnyDate As Date)
If (DatePart("w", AnyDate) = 1) Or (DatePart("w",
AnyDate) = 7) Then
    IsWeekend = True
Else
    IsWeekend = False
End If
End Function

```

```

*****
' Function IsHoliday(AnyDate As Date) Microsoft Access
' Returns True if AnyDate is a Holiday, False Otherwise.
' Uses the Holidays table to check for holidays.
*****
Public Function IsHoliday(AnyDate As Date)
If (DCount("[Date]", "Holidays", "[Date]=#" &
Format(AnyDate, "mm/d/yyyy") & "#") > 0) Then
    IsHoliday = True
Else
    IsHoliday = False
End If
End Function

```



FIGURE 3: The BdayAdd function lets you add days to a date and make sure the resulting date doesn't fall on a weekend or a holiday.

```

If (DatePart("w", AnyDate) = 1) Or
'Sun
    (DatePart("w", AnyDate) = 7) Then
'Sat

```

Note that if you wanted to speed up the IsWeekend function, you could use the following line instead:

```

If (DatePart("w", AnyDate) Mod 7 <= 1)
Then

```

Its meaning is not as obvious, but it makes one fewer call to the DatePart function. This approach is possible, because both Saturday and Sunday satisfy the If test (7 Mod 7 or 1 Mod 7), while the other days do not.

The IsHoliday function returns True if the date passed is a Holiday in the Holidays table. The function assumes that the Holidays table contains a column called Date, of type Date, and that this column contains the date values representing official nonworking holidays. (Of course, you'll have to keep the Holidays table current for this technique to work correctly.) The IsHoliday function uses the DCount function to determine if a matching date exists in the Holidays table.

BDAYAD.VBA can be downloaded from PC Magazine Online. For details, see the sidebar "Getting the Files" in this issue's Utilities column.—*Sal Ricciardi*

The "Cannot Quit FoxPro" Dilemma

When I double-click my FoxPro application's control-menu box to quit the application, I

consistently get a "Cannot Quit FoxPro" error message. What am I doing wrong?

DAVID GOLD
Baltimore, Maryland

PC MAGAZINE: The "Cannot Quit FoxPro" message is usually caused by forgetting to include the ON SHUTDOWN command and its associated logic. The best place to add the command to your application is early in the application's start-up code. The command's purpose is to tell FoxPro the name of a cleanup routine to call when the user attempts to exit the application. In the cleanup routine, you close all of your data files, restore any environment settings and any other settings that need to be restored, and then end the routine with either the QUIT command or, to return to FoxPro during development, the CANCEL command. For instance,

```
ON SHUTDOWN MyExit
```

tells FoxPro to execute the MyExit procedure when the user tries to exit FoxPro by double-clicking the control-menu box, for instance, or by choosing Close on the control menu. Your MyExit code might be structured like this:

```

ON SHUTDOWN *
CLEAR READ ALL
CLOSE ALL
CLEAR ALL
* etc.
QUIT

```

It's always good practice to start an ON routine by immediately turning off the ON command that got you there. The ON SHUT-

DOWN * command does this. This way, the code cannot be reentered. If this were a different ON command (ON ERROR, for example), you could then restore the ON command near the end of the ON routine, but with ON SHUTDOWN, it's not usually necessary, because the last command is most often QUIT.

Of course, you could use your MyExit routine to display an "Are You Sure You Want to Quit This Application?" dialog. In case the user answers No, you would want to restore the ON SHUTDOWN MyExit command and simply issue the RETURN command instead of QUIT to return control to your application.—*Sal Ricciardi*

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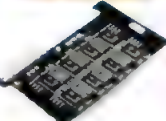
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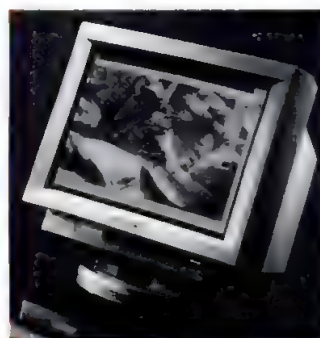
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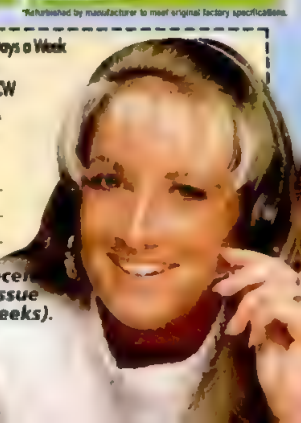
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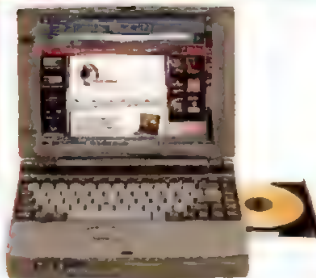


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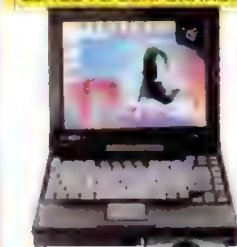
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1 modem or memory upgrade per notebook. Offers cannot be combined.

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*Factory refurbished. Call for details.

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memory upgrades

NEC

NEC Versa 6000

Model	CPU	Screen	RAM/HD	CD	Price
6010H	133MHz	11.3" Active	16MB/1.08GB	6X	\$3699
6030H	133MHz	12.1" Active	16MB/1.3GB	6X	4999
6030X	133MHz	12.1" Active	16MB/1.4GB	6X	5399

NEC Versa 4200

Model	CPU	Screen	RAM/HD	CD	Price
4200	100MHz	10.4" Active	8/810MB	Opt.	\$2999
4230	133MHz	10.4" Active	8MB/1.0GB	6X	3899

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NEC Versa 6000 Series

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Hitachi E Series
Notebook



Hitachi E Series

Model	CPU	Screen	RAM/HD	CD	Price
E100D	100MHz	11.3" Dual Scan	16/810MB	Opt.	\$1799
E133DN	133MHz	11.3" Dual Scan	16/1.08GB	Opt.	1999
E133T	133MHz	11.3" Active	16/810MB	Opt.	2599

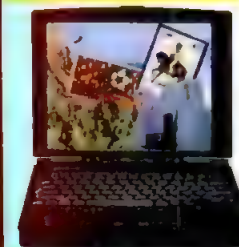
Hitachi M Series

Model	CPU	Screen	RAM/HD	CD	Price
M100D	100MHz	11.3" Dual Scan	8/810MB	4X	\$1999
M120T	120MHz	11.8" Active	16MB/1GB	4X	2999
M133T	133MHz	11.8" Active	16MB/1GB	6X	3499

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**Additional M Series models
available. Call for details.**

TEXAS INSTRUMENTS



Extensa 600

Model	CPU	Screen	RAM/HD	CD	Price
600CD	120 MHz	12.1" Dual Scan	8/810MB	6X	\$2249

TravelMate 6000

Model	CPU	Screen	RAM/HD	CD	Price
6020	120MHz	11.3" Active	16MB/1.08GB	6X	\$3799
6030	133MHz	12.1" Active	16MB/1.35GB	Opt.	4299
6050	150MHz	12.1" Active	16MB/1.35GB	Opt.	4699

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EXTENSA 650**

Extensa 600CD

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Ascentia P

AST Ascentia P

Model	CPU	Screen	RAM/HD	CD	Price
A40	120MHz	11.3" Dual Scan	16MB/1.0GB	6X	\$2399
A40	120MHz	12.1" Active	16MB/1.0GB	6X	2999
P50	133MHz	12.1" Active	24MB/1.0GB	4X	3899
P50	133MHz	12.1" Active	24MB/2.1GB	4X	4299

AST Ascentia J

Model	CPU	Screen	RAM/HD	CD	Price
J30	100MHz	10.4" Dual Scan	8/800MB	Opt.	\$1699
J30	100MHz	10.4" Active	8/800MB	Opt.	1799
J50	133MHz	10.4" Active Matrix	8/800MB	Opt.	2249

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Additional models available. Call for details.

digital



Digital
Ultra II
with
external
Floppy
Disk

Digital HiNote VP & VP 500

Model	CPU	Screen	RAM/HD	CD	Price
HiNote VP	120MHz	11.3" Dual Scan	8/1.08MB	Opt.	\$1799
VP 500	120MHz	11.3" Dual Scan	8MB/1.08GB	6X	2449
VP 500	133MHz	12.1" Active	8MB/1.44GB	6X	3599

Digital Ultra

Model	CPU	Screen	RAM/HD	CD	Price
Ultra II	133MHz	11.3" Active	16MB/1.35GB	Opt.	\$4499
Ultra II	150MHz	11.3" Active	16MB/1.44GB	Opt.	4799

Additional models available. Call for details.

SHARP



Sharp
WideNote

Sharp WideNote

Model	CPU	Screen	RAM/HD	CD	Price
W100D	133MHz	11.2" Wide Dual Scan	16MB/1.1GB	Opt.	\$2999
W100T	133MHz	11.2" Wide Active	16MB/1.1GB	Opt.	3499

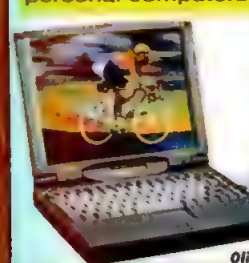
Sharp 3000 & 9000

Model	CPU	Screen	RAM/HD	CD	Price
3040	100MHz	12.1" Dual Scan	8MB/1.1GB	Opt.	\$1499
9020	120MHz	12.1" Dual Scan	16MB/1.1GB	6X	2199
9050	133MHz	11.3" Active (SHA)	16MB/1.1GB	6X	2899
9080	133MHz	12.1" Active (SHA)	16MB/1.3GB	6X	4499

Additional models available. Call for details.

olivetti

personal computers



Olivetti Echos Series Notebook

Olivetti Echos

Model	CPU	Screen	RAM/HD	CD	Price
Echos	100MHz	11.3" Dual Scan	8MB/1.3GB	6X	\$1999
Echos	100MHz	10.4" Active	8MB/1.3GB	6X	2599
Echos	120MHz	11.3" Active	8MB/1.3GB	6X	2999
Echos	133MHz	11.8" Active	16MB/1.3GB	6X	3499
Pro	133MHz	12.1" Dual Scan	16MB/1.3GB	8X	3499
Pro	133MHz	12.1" Active	16MB/2GB	8X	3999
Pro	150MHz	12.1" Active	16MB/2GB	8X	4999



hp

HEWLETT
PACKARD



HP OmniBook
800 Notebook PC

HP OmniBook 800

Model	CPU	Screen	RAM/HD	CD	Price
800CS	100MHz	10" Dual Scan	16/810MB	Opt.	\$2999
800CT	133MHz	10.4" Active	16MB/1.4GB	Opt.	4279

HP OmniBook 5500

Model	CPU	Screen	RAM/HD	CD	Price
5500CTS	120MHz	10.4" Active	16MB/1.35GB	Opt.	\$3899
5500CTS	133MHz	12.1" Active	16MB/1.35GB	Opt.	4519
5500CTS	133MHz	12.1" Active	16MB/2GB	Opt.	4859

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- 16-bit WaveTable 3-D theatre sound
- Comes with over 40 software titles

Model	CPU	RAM	HD	CD	Price
23	120MHz	16MB/1.6GB	8X		\$1599
33	133MHz	16MB/1.6GB	8X		1749
65	166MHz	16MB/2.0GB	8X		2049
73	200MHz	16MB/2.5GB	8X		2129
77	200MHz	32MB/3.2GB	8X		2359

Monitors priced separately

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PENTIUM**

IBM Aptiva Series

IBM Aptiva S Series

- Up to 200MHz Pentium processors
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- Cordless mouse/joystick models
- Integrated audio on optional monitor

Model	CPU	RAM	HD	CD	Price
S64	166MHz	16MB/2.5GB	8X		\$2249
S66	166MHz	16MB/2.2GB	8X		2399*
S74	200MHz	16MB/3.0GB	8X		2399
S78	200MHz	16MB/3.6GB	8X		2699*

* Includes cordless mouse and joystick

Aptiva S Series Monitors

Model	Size	View	Resolution	Price
MM50	15"	13.7"	1024 x 768	\$499
MM70	17"	15.7"	1024 x 768	799

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- Up to 2.5GB hard drives

Model	CPU	RAM	HD	CD	Price
4704	133MHz	16MB/1.6GB	6X		\$1599
4712	166MHz	24MB/2.5GB	6X		1999
4716	200MHz	32MB/2.5GB	8X		2199

Presario Monitors

Model	Size	View	Resolution	Price
Presario 14"	12.9"	1024 x 768		\$399
Presario 15"	13.5"	1024 x 768		499
Presario 17"	15.6"	1280 x 1024		749

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Toshiba Infinia Multimedia

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7130	133MHz	16MB/1.6GB	8X		\$1599
7160	166MHz	16MB/2.1GB	8X		1799
7200	200MHz	16MB/3.0GB	8X		2799

Infinia Monitors

Model	Size	View	Resolution	Price
Infinia 15"	13.78"	1280 x 1024		\$459
Infinia 17"	16.23"	1280 x 1024		759

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- 28.8 or 33.6 data/fax/voice modem
- Integrated 5.1 surround sound
- Video conferencing & tuner card on 9312 model

Model	CPU	RAM/HD	CD	Price
9304	133MHz	24MB/1.6GB	8X	\$1599*
9308	166MHz	24MB/2.5GB	8X	1899*
9310	166MHz	24MB/2.5GB	8X	2199*
9312	166MHz	24MB/2.5GB	8X	2299*
9315	166MHz	32MB/2.5GB	8X	2399*
9314	200MHz	24MB/4.0GB	8X	2299*
9316	200MHz	32MB/3.0GB	8X	2699*

* Features a 33.6 data/fax/voice modem

Monitors priced separately



Monitors priced separately

Product differs slightly from photo

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Ready Multimedia

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- Up to 4MB standard video memory
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Model	CPU	RAM/HD	CD	Price
7622	120MHz	16MB/1.6GB	8X	\$1599
9620	133MHz	16MB/1.6GB	8X	1699
9624	133MHz	16MB/2.0GB	8X	1899
9622	166MHz	16MB/2.5GB	8X	2099
9628	166MHz	32MB/3.2GB	8X	2599
9629	200MHz	32MB/3.2GB	8X	2699

Monitors priced separately

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Model	CPU	RAM/HD	CD	Price
VAIO	166MHz	32MB/2.1GB	8X	\$1999
VAIO	200MHz	32MB/2.5GB	8X	2299

VAIO Monitor

Model	Size	View	Price
VAIO	15"	13.9"	\$579



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DESCRIPTION
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\$1099
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• PA1207U-S6WB
DESCRIPTION
Pentium 75 8MB 772MB

HP Pavilion Multimedia

PRODUCT	PART #	PRICE
Pentium 90, 8MB, 1.2GB, Pavilion 7030	7030	\$ 899
Pentium 120, 16MB, 1.6GB, Pavilion 7055	7055	1299
Pentium 133, 16MB, 1.6GB, Pavilion 7125	7125	1449

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Product shown with optional CD

• PC-6110-71602-R

DESCRIPTION

Processor: 100, 16MB, 1.2GB



Product differs from photo

• PC-602011602MX-R

DESCRIPTION

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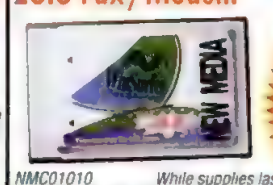
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89⁹⁷

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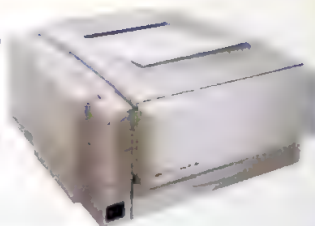
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- 28.8/14.4 Data/Fax Modem
- 8X CD-ROM

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2999⁹⁷

15" 28" Monitor (13.1" viewable image size) #104475 499⁹⁷
3 Year Service Plan #10585 299⁹⁷
5 Year Service Plan #10585 299⁹⁷

Computers

Packard Bell D160 P133 32 MB RAM/1.6 GIG HD, 28.8/14.4 Data/Fax Modem, 6X CD-ROM Drive #132846	159 ⁹⁷
Toshiba 7160 P166 16 MB RAM/1.9 GIG HD, 33.6/14.4 Data/Fax Modem, 8X CD-ROM Drive #131579	1799 ⁹⁷
Compaq 8702 P166 24 MB RAM/2.5 GIG HD, 33.6/14.4 Data/Fax Modem, 8X CD-ROM Drive #131552	1999 ⁹⁷
Sony PCY70 P166 32 MB RAM/2.1 GIG HD, 28.8/14.4 Data/Fax Modem, 8X CD-ROM Drive #137778	2299 ⁹⁷
Compaq 4716 P200 32 MB RAM/2.5 GIG HD, 36.6/14.4 Data/Fax Modem, 8X CD-ROM Drive #131549	2299 ⁹⁷
Packard Bell 755 P200 32 MB RAM/2.5 GIG HD, 33.6 Internal Data/Fax Modem, 8X CD-ROM Drive #132870	2499 ⁹⁷
IBM C77 P200 32 MB RAM/3.2 GIG HD, 28.8/14.4 Data/Fax Modem, 8X CD-ROM Drive #140835	2599 ⁹⁷
Toshiba 7200 P200 32 MB RAM/3.0 GIG HD, 33.6/14.4 Data/Fax Modem, 8X CD-ROM Drive #131578	2700 ⁹⁷

Printers

Canon BJC-4200 Printer #133405	279 ⁹⁷
HP DeskJet 693C Printer #140507	349 ⁹⁷
HP DeskJet 820Cse Printer #120440	399 ⁹⁷
HP LaserJet 5 Printer #120489	1299 ⁹⁷

Notebooks

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Canon 490CJT P133 16 MB RAM/1.0 GIG HD, 11.3" TFT, 6X CD-ROM #134965	2899 ⁹⁷
Texas Instruments 655CD P133 16 MB RAM/1.2 GIG HD, 12.1" Dual-Scan Screen, 8X CD-ROM Drive #138854	2999 ⁹⁷
NEC 2435CD P133 16 MB RAM/1.08 GIG HD, 11.3" Dual-Scan Screen, 6X CD-ROM Drive #138857	2999 ⁹⁷

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Linksys Ethernet Combo 10BT + 10B2 #118435	109 ⁹⁷
3Com Etherlink III 10BT #110135	159 ⁹⁷
Xircom Libernet Performance 10BT #187262	189 ⁹⁷
Elgar 33.6 #140009	209 ⁹⁷
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3166MB	Caviar	12ms	128	5,200	16.6MB/sec	3.5" 1"H	Enhanced IDE	3 Year	WD33100AB	379.99
Mobile Products										
810MB	Marathon	16ms	120	4,500	16.6MB/sec	2.5" 19.15mm	Fast ATA-2	3 Year	ST9816AG	\$349.99
1650MB	Marathon si	14ms	120	4,500	16.6MB/sec	2.5" 12.7mm	Fast ATA-2	3 Year	ST1350AG	429.99
Desktop PC Products										
1082MB	ST31081A	14ms	64	3,600	16.6MB/sec	3.5" 1"H	Fast-ATA-2	3 Year	ST31081AB	\$169.99
1275MB	ST31276A	12.5ms	64	4,500	16.6MB/sec	3.5" 1"H	Fast-ATA-2	3 Year	ST31276AB	189.99
1700MB	Medalist 1720	12ms	128	4,500	16.6MB/sec	3.5" 1.02"H	Fast-ATA-2	3 Year	ST31720AB	219.99
2113MB	Medalist 2140	10ms	128	5,400	16.6MB/sec	3.5" 1.02"H	Fast-ATA-2	3 Year	ST32140AB	249.99
2560MB	Medalist Pro	11ms	128	5,400	16.6MB/sec	3.5" 1.02"H	Fast-ATA-2	3 Year	ST52520AB	315.99
2.5" Hard Drives										
810MB	Slimline	13ms	128	4,200	13.3MB/sec	2.5" 12.7MM	Fast-ATA	1 Year	MK1926FCV	\$299.99
1300MB	Slimline	13ms	128	4,200	13.3MB/sec	2.5" 12.7MM	Fast-ATA	1 Year	MK1301MAV	449.99
1300MB	Notebook	13ms	128	4,200	13.3MB/sec	2.5" 19MM	Fast-ATA	1 Year	MK2720PC	459.99
2100MB	Notebook	13ms	128	4,200	13.3MB/sec	2.5" 19MM	Fast-ATA	1 Year	MK2101MAN	599.99
1090MB	Winchester	12ms	64	4,500	16.6MB/sec	3.5" 1"H	Fast-ATA-2	3 Year	FJ1614AB	\$175.99
1280MB	Winchester	12ms	64	4,500	16.6MB/sec	3.5" 1"H	Fast-ATA-2	3 Year	FJ1636AB	199.99
1700MB	Winchester	12ms	64	4,500	16.6MB/sec	3.5" 1"H	Fast-ATA-2	3 Year	FJ1623AB	229.99
2100MB	Winchester	12ms	64	4,500	16.6MB/sec	3.5" 1"H	Fast-ATA-2	3 Year	FJ1624AB	279.99
2560MB	Winchester	12ms	64	4,500	16.6MB/sec	3.5" 1"H	Fast-ATA-2	3 Year	FJ1638AB	299.99
1708MB	Sirocco	11ms	128	4,500	16.6MB/sec	3.5" 1"H	Fast-ATA-2	3 Year	QUSR1708AB	\$225.99
2168MB	Fireball™	10.5ms	128	4,500	16.6MB/sec	3.5" 1"H	Fast-ATA-2	3 Year	QUTM2110AB	279.99
2550MB	Sirocco	11ms	128	4,500	16.6MB/sec	3.5" 1"H	Fast-ATA-2	3 Year	QUSR2550AB	319.99
3254MB	Fireball™	10.5ms	128	4,500	16.6MB/sec	3.5" 1"H	Fast-ATA-2	3 Year	QUTM3200AB	359.99
1336MB	Durango	11ms	64	4,500	16.6MB/sec	3.5" 1"H	Enhanced IDE	3 Year	MX71336AB	\$209.99
1670MB	Durango	12ms	256	4,500	16.6MB/sec	3.5" 1"H	Enhanced IDE	3 Year	MX71626AB	235.99
2004MB	Durango	11ms	128	4,500	16.6MB/sec	3.5" 1"H	Enhanced IDE	3 Year	MX72004AB	285.99
1700MB	Deskstar	12ms	128	4,500	16.6MB/sec	3.5" 1"H	Fast-ATA-2	3 Year	IB06H8724B	\$299.99

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Capacity*	Model	Access	Cache	RPM	Max. Trans. Rate	Form/fgt.	Interface	Mfr.'s Wrrty.	Product Code	Price
50 Pin Standard and 68 Pin Wide Value Drives										
1080MB	Medalist	12.5ms	128	5,400	10MB/sec	3.5" HH	Fast SCSI-2 A/V	3 Year	ST51080NB	\$249.99
1050MB	Hawk 2XL	9ms	512	5,411	20MB/sec	3.5" 1"H	Ultra SCSI	3 Year	ST31055NB	349.99
1050MB	Hawk 2XL	9ms	512	5,411	40MB/sec	3.5" 1"H	Ultra Wide SCSI	3 Year	ST31055WB	389.99
2149MB	Hawk 2XL	9ms	512	5,400	20MB/sec	3.5" 1"H	Ultra SCSI	5 Year	ST32155NB	479.99
2149MB	Hawk 2XL	9ms	512	5,400	40MB/sec	3.5" 1"H	Ultra Wide SCSI	5 Year	ST32155WB	515.99
4294MB	Hawk 4	9ms	512	5,411	10MB/sec	3.5" HH	Fast SCSI-2 A/V	5 Year	ST15230NB	949.99
4294MB	Hawk 4	9ms	512	5,411	20MB/sec	3.5" HH	Fast Wide SCSI-2 A/V	5 Year	ST15230WB	989.99
50 Pin Standard and 68 Pin Wide Performance Drives										
2147MB	Barracuda 2LP	8ms	512	7,200	10MB/sec	3.5" 1"H	Fast SCSI-2 A/V	5 Year	ST32550NB	\$749.99
2147MB	Barracuda 2LP	8ms	512	7,200	20MB/sec	3.5" 1"H	Fast Wide SCSI-2 A/V	5 Year	ST32550WB	799.99
2150MB	Barracuda 4LP	8ms	512	7,200	20MB/sec	3.5" 1"H	Ultra SCSI	5 Year	ST32171NB	749.99
2150MB	Barracuda 4LP	8ms	512	7,200	40MB/sec	3.5" 1"H	Ultra Wide SCSI	5 Year	ST32171WB	799.99
4294MB	Barracuda 4	8ms	1,024	7,200	10MB/sec	3.5" HH	Fast SCSI-2 A/V	5 Year	ST15150NB	1,049.99
4294MB	Barracuda 4	8ms	1,024	7,200	20MB/sec	3.5" HH	Fast Wide SCSI-2 A/V	5 Year	ST15150WB	1,099.99
4350MB	Barracuda 4LP	8ms	512	7,200	20MB/sec	3.5" 1"H	Ultra SCSI	5 Year	ST34371NB	1,149.99
4350MB	Barracuda 4LP	8ms	512	7,200	40MB/sec	3.5" 1"H	Ultra Wide SCSI	5 Year	ST34371WB	1,199.99
9090MB	Elite 9	11ms	1,024	5,400	10MB/sec	5.25" FH	Fast SCSI-2 A/V	5 Year	ST410800NB	1,999.99
9090MB	Elite 9	11ms	1,024	5,400	20MB/sec	5.25" FH	Fast Wide SCSI-2 A/V	5 Year	ST410800WB	2,049.99
9100MB	Barracuda 9	8ms	512	7,200	20MB/sec	3.5" HH	Ultra SCSI	5 Year	ST19171NB	2,099.99
9100MB	Barracuda 9	8ms	512	7,200	40MB/sec	3.5" HH	Ultra Wide SCSI	5 Year	ST19171WB	2,149.99
2170MB	Enterprise	8ms	512	7,200	20MB/sec	3.5" 1"H	Ultra SCSI	5 Year	WD2170SB	\$759.99
2170MB	Enterprise	8ms	512	7,200	40MB/sec	3.5" 1"H	Ultra Wide SCSI	5 Year	WD2170WB	799.99
4360MB	Enterprise	8ms	512	7,200	20MB/sec	3.5" 1"H	Ultra SCSI	5 Year	WD4360SB	1,129.99
4360MB	Enterprise	8ms	512	7,200	40MB/sec	3.5" 1"H	Ultra Wide SCSI	5 Year	WD4360WB	1,179.99
4360MB	Enterprise	8ms	512	7,200	40MB/sec	3.5" 1"H	Ultra Wide SCSI-3/SCA	5 Year	WD4360WC	1,199.99
2100MB	Aries	8.5ms	512	5,400	10MB/sec	3.5" 1"H	Fast SCSI-2	5 Year	MC4421SB	\$429.99
2100MB	Taurus	8.9ms	512	7,200	10MB/sec	3.5" 1"H	Fast SCSI-2	5 Year	MC4221SB	549.99
4300MB	Capricorn	8.5ms	512	7,200	10MB/sec	3.5" HH	Fast SCSI-2	5 Year	MC3243SB	859.99
9100MB	Scorpio	12ms	512	5,400	10MB/sec	5.25" FH	Fast SCSI-2	5 Year	MC1991B	1,649.99
68 Pin Wide SCSI Drives										
2100MB	Taurus	8.5ms	512	7,200	20MB/sec	3.5" 1"H	Fast Wide SCSI-2 A/V	5 Year	MC4221AVWB	\$739.99
4300MB	Capricorn	8.5ms	512	7,200	20MB/sec	3.5" HH	Fast Wide SCSI-2 A/V	5 Year	MC3243AVWB	1,029.99
9100MB	Scorpio	12ms	512	5,400	20MB/sec	3.5" FH	Fast Wide SCSI-2 A/V	5 Year	MC1991AVWB	1,899.99
9100MB	Tomahawk	8ms	512	7,200	20MB/sec	3.5" HH	Ultra SCSI	5 Year	MC3391NSB	1,999.99
9100MB	Tomahawk	8ms	512	7,200	40MB/sec	3.5" HH	Ultra Wide SCSI	5 Year	MC3391WSB	2,039.99
1280MB	Tempest	10.5ms	128	4,500	20MB/sec	3.5" 1"H	Ultra SCSI	3 Year	QUTM1280SB	\$319.99
2100MB	Tempest	10.5ms	128	4,500	20MB/sec	3.5" 1"H	Ultra SCSI	3 Year	QUTM2100SB	399.99
3200MB	Tempest	10.5ms	128	4,500	20MB/sec	3.5" 1"H	Ultra SCSI	3 Year	QUTM3200SB	499.99
2150MB	Atlas	8ms	1,024	7,200	20MB/sec	3.5" 1"H	Fast Wide SCSI-2	5 Year	QUXP3125WB	679.99
4300MB	Atlas	8ms	1,024	7,200	20MB/sec	3.5" HH	Fast Wide SCSI-2	5 Year	QUXP3430WB	949.99

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AST Ascenda P50 P133 12.1" TFT 24MB RAM 1GB-R HDD Touch Pad 503041-501	3,989.99
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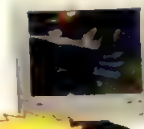


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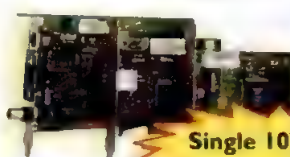
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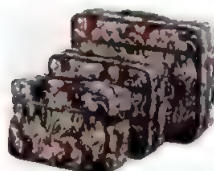
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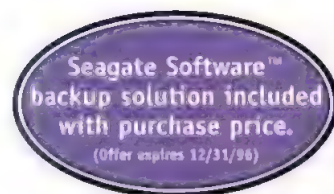
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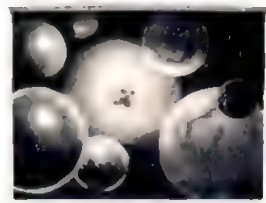
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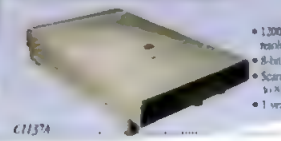


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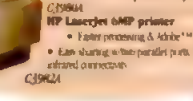
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Tecra 500CPT P120 12.1" Act, 1GB	\$3171		365XCD P120 10.8" Act, 810MB	\$2487	
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Satellite 110CS P100 11.5" DS, 810MB	\$2517		660 P120 12.1" Act, 810MB	\$3724	
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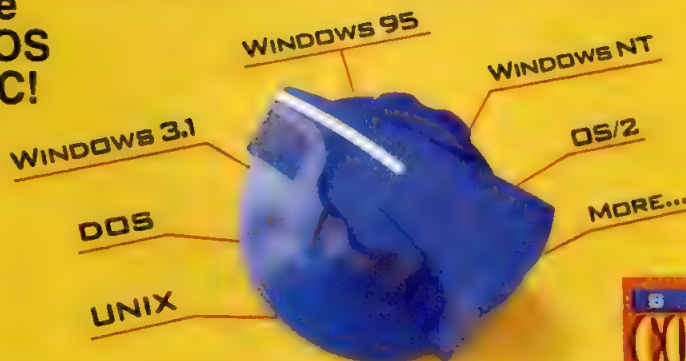
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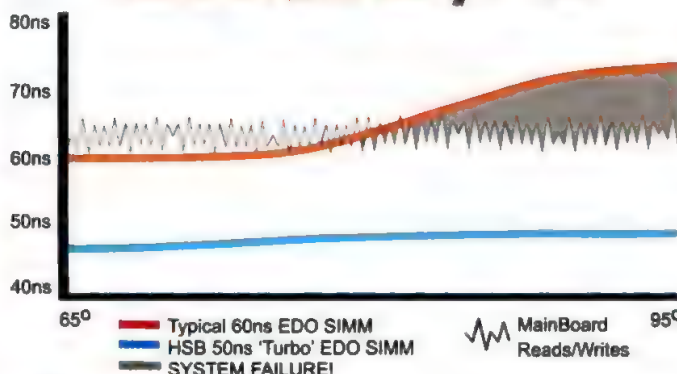
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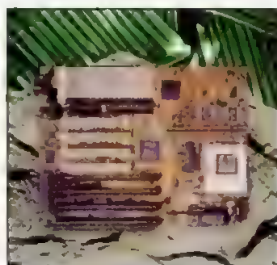
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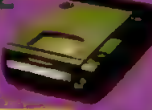
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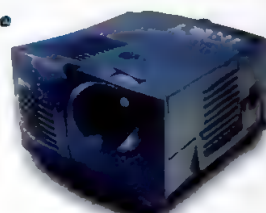
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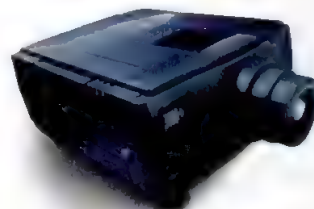
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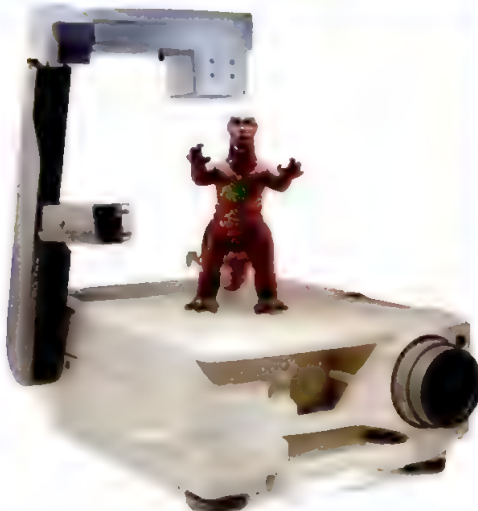
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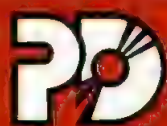
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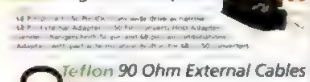
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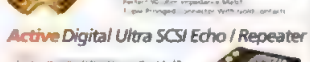
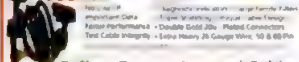
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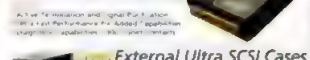
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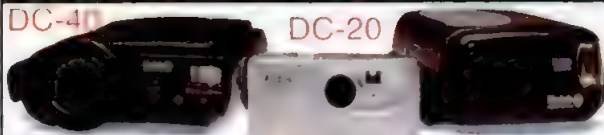
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March/April 1996

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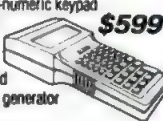
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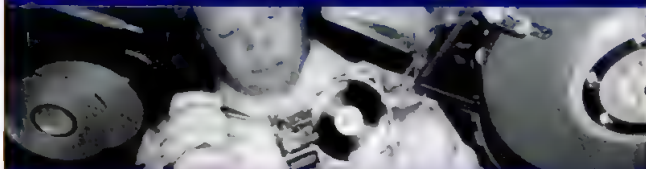
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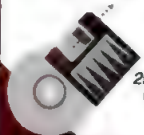
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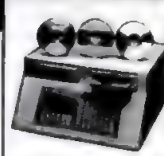
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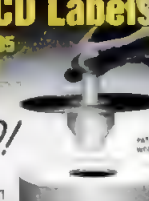
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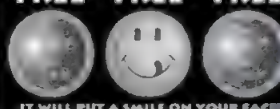
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Avalon Hill Game Company is perhaps the best-known and most respected publisher of tabletop war games, but it remains a cult favorite at best in the computer gaming sphere. With the release of *Wooden Ships & Iron Men*, however, Avalon Hill may have finally broken through to computer gaming's big time.

Wooden Ships & Iron Men (WSIM) is a DOS-based strategy game of ship-to-ship combat during the Revolutionary (1775–1783) and Napoleonic (1793–1815) periods. While fans of Patrick O'Brian and C. S. Forester will feel right at home with this game, those unfamiliar with naval history should also appreciate WSIM's easy-to-learn interface and addictive game play.

WSIM offers two main

modes of play: standalone scenarios and campaign mode. If you choose the first option, you can take part in one of the game's 17 historical scenarios, which include the famous frigate duel between John Paul Jones's *Bonhomme Richard* and the British *Serapis* as well as a portion of the Battle of Trafalgar. In each scenario, you can take command of every ship on your side of the battle.

The scenarios are realistic and enjoyable, but since there are only 17, you may get bored in a hurry. Fortunately, with the game's powerful editor, you can create your own naval battles.

In campaign mode, you'll command a U.S. Navy ship during the War of 1812. You can command sloops and brigs in this mode, but the real fun starts when you step onto the virtual quarterdeck of a 44-gun



frigate. The campaign unfolds as a series of uneventful days, interspersed with random encounters with British merchant vessels and warships. Campaign mode is enjoyable but a bit too random at times. Also, no option is available for campaigning for the British, Dutch, French, or Spanish fleets.

In both modes, the battles take place over a series of turns. As you plot your moves, you'll have to keep an eye on the wind direction: One false maneuver can leave your ship helplessly taken aback. You'll also have to pay attention to your sails (you may need to spread more canvas to catch—or flee—a fast-moving enemy); guns, including the type of ammunition and the basic aiming point (hull or rigging); and ship-to-ship boarding parties.

Although Age-of-Sail naval combat is an intricate process, WSIM does a good job of simplifying it to keep the game fun yet realistic. The helpful man-

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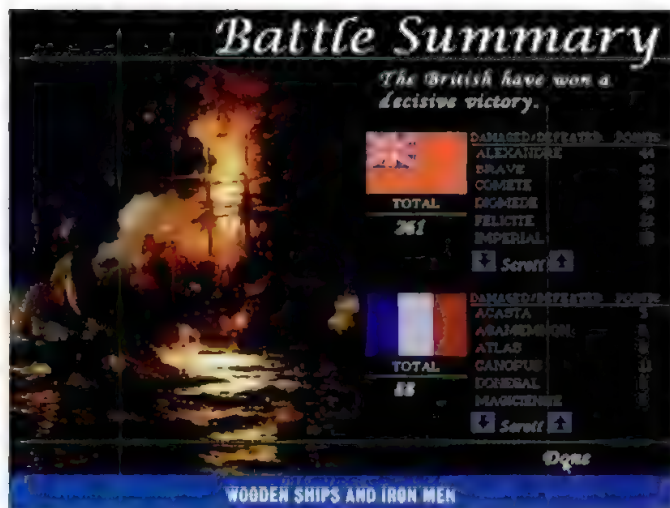
The game's artificial intelligence is challenging, though for more lifelike competition, you can take on a friend in hot-seat or play-by-e-mail games.

The game has a few faults, such as a strange damage and repair system (repairs can be made during and immediately after a battle, but not on the uneventful days of a campaign). Also, WSIM crashed periodically when run in a Microsoft Windows 95 DOS box.

On the whole, however, WSIM is an impressive title, an engaging alternative to your usual strategy fare.—Michael E. Ryan

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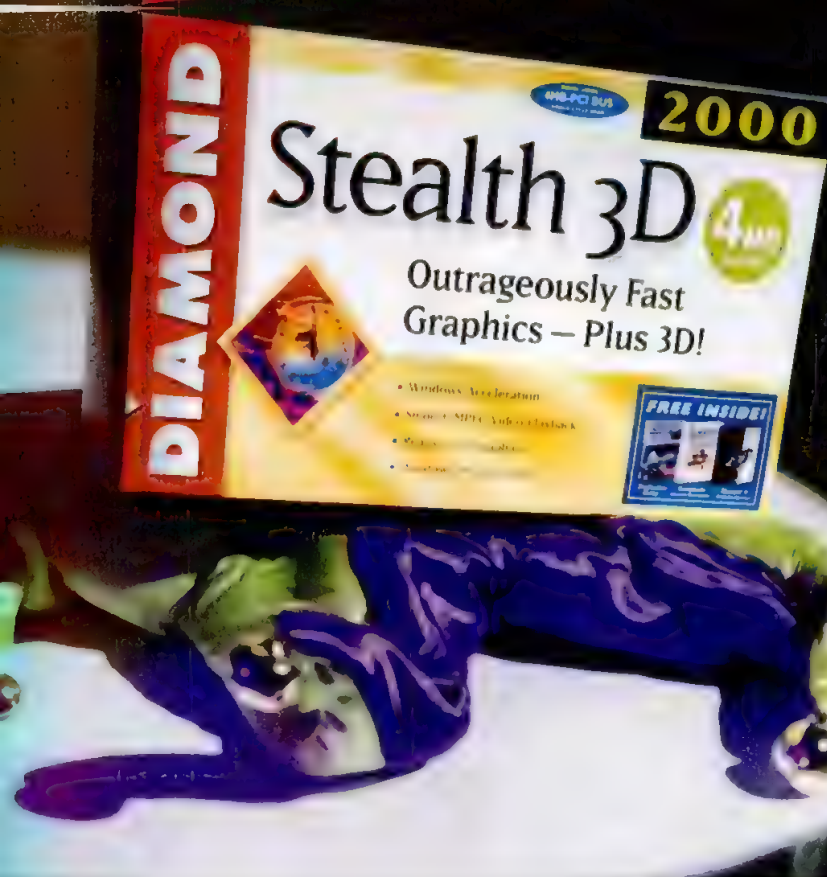
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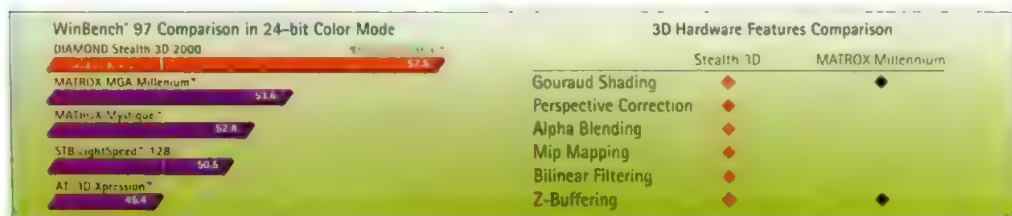
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Remember when PC audio meant a disturbing array of ear-piercing beeps? Thankfully, those days have fallen before the 32-bit wavetable revolution. In today's multimedia world, PCs not only generate some spectacular game sound effects, but they also can reproduce genuine high-fidelity music.

For this review, we auditioned 11 speaker systems, priced from \$89 to \$230. Using a mix of classical and jazz material, along with a sound pressure level (SPL) meter to ensure that each system produced the same volume, we gave every set an overall rating on After Hours' five-star scale (with five stars being the best).

But first some audio tips. As with home stereo equipment, the widest variation in sonic quality comes from the speaker system you use, so you'll want to shop around. Be sure to take a few of your favorite music CDs with you when shopping, and always remember: Never buy a set of speakers you haven't heard. When you decide on a set, you'll want to move the two satellite speakers around on your desk until you get the widest, deepest soundstage you can without developing an acoustic hole in the middle.

Advent AV270 Powered Partners

The Advent AV270 Powered Partners comprise two desktop units, each with a sloping panel that contains a woofer and a tweeter. The system includes bass, treble, and balance con-

trols and is rated overall at a peak power of 25 watts. The AV270 produced a soundstage with good width and medium depth. It delivered good tone in the drums and acoustic guitar, though we noted a slight stridency in the horns and strings. It also seemed to lack deep bass power. \$179 list; International Jensen, Advent Division, 800-323-0707, www.adventaudio.com.

Altec Lansing ACS45

Two desktop cubes and an under-desk subwoofer make up the Altec Lansing ACS45. Buttons on one of the satellites



raise and lower the volume in reasonably small increments; the subwoofer has its own control. The amplifiers in the desktop satellites are each rated at 6 watts, and the subwoofer at 20 watts.

The acoustic soundstage was wide and very deep, producing fine orchestral sound on the massed-strings test, but we noted that the subwoofer got slightly boomy if driven too hard. The piano tone in a Mozart concerto was pure Steinway, however, and on the jazz test, the sax and vibes were very musical. \$99 list; Altec Lansing Technologies Inc., 800-648-6663, www.altecmm.com.

Product Name & Rating	
AV270 Powered Partners	★★★★
Altec Lansing ACS45	★★★★
Soundworks	★★★★
Creative Labs SB380	★★★★
Jazz JS-300 3D	★★★★
JBL Media 2	★★★
Labtec LCS-3210	★★★
TC-1525 Mach II	★★★★
Roland MA-8	★★★★
Sony SRS-PC61	★★★
Yamaha YST-M15	★★★★

Cambridge's Soundworks

The Soundworks is a three-piece system consisting of two small desktop cubes (rated at 4.1 watts each) and a 10.3-watt under-desk subwoofer with its own volume control. Overall volume is adjusted with a knob at the end of a pair of wires that can be connected via Velcro fasteners to a handy spot.

The Soundworks system produced an admirably neutral sound with our pink-noise calibration tone. Massed orchestral strings had the smooth and delicate sound of a disciplined string section, and the piano tone was superb. The soundstage was both wide and deep, and individual instruments could be clearly pinpointed. In our jazz selection, the vibes, sax, and bass were excellent. So although the system costs more than most others in this review, the Soundworks delivers genuine hi-fi stereo quality that's difficult to beat. \$220 street; Cambridge Soundworks Inc., 800-367-4434, www.hifi.com.

Creative Labs SB380

The Creative Labs SB380 is a two-piece system with a separate woofer and tweeter in each unit. It is rated at a suggested 10 watts (20 watts peak) and has bass, treble, and on-off/volume controls, plus a button that adds 3-D enhancement. This enhancement works to deepen the bass and broaden the image, but at the cost of spatial accuracy. The treble control tamed some overzealous high notes on the piano test. Without the 3-D enhancement, our jazz selection showed good acoustic depth and fair width, though the speakers had to be separated more widely than usual. Tone in the vibes and sax was good though not great, and the 3-D circuit seemed to worsen the fidelity slightly. In our classical selection the 3-D cut the treble and boosted the bass, seeming to produce a slight echo-chamber effect. \$100 street; Creative Labs Inc., 800-998-1000, www.creativelabs.com.

JAZZ JS-300 3D

The JAZZ JS-300 3D is a two-piece system having volume, treble, bass, and balance controls, with 3-D, muting, and power switches, as well as a three-way game/theater/music switch. The system produced



smooth-sounding pink noise in the music position, but flipping on the Spatializer 3-D enhancement dropped the listening level significantly. Without the 3-D enhancement, the jazz

After Hours

selection produced a good open-room feel and very good overall tone in the piano, sax, vibes, and drums.

Also on the jazz test, the game/theater/music switch seemed to work only with the Spatializer activated, when the game position boosted the volume considerably. In the classical-music test, the notes in piano runs were not perfectly distinct yet still good. With the Spatializer on, all sense of orchestral instrument locations was lost (as when listening to speakers out of phase). With 3-D enhancement and in the game position, the sound was very harsh, and the much-boosted midrange made for difficult listening. \$99 list; JAZZ Speakers, 800-291-8999, www.jazzspeakers.com.

JBL Media2

The JBL Media2 is composed of a pair of desk-mounted, L-shaped units with volume, bass, and treble controls and a 10-



CAMBRIDGE'S SOUNDWORKS

watt amplifier rating. On our listening tests, the system easily overloaded when we tried to get high-volume sound in the classical selections, and it produced a shrill tone on high notes. It was also harsh on our orchestral strings, jazz ensemble, and piano tests. The soundstage had adequate width but little depth, and it was difficult to pinpoint orchestral instrument locations. \$99.95 list; JBL Consumer Group, 800-336-4525, www.jbl.com.

Labtec LCS-3210

The Labtec LCS-3210 consists of two thin but relatively deep desktop units rated at a suggested 10 watts (20 watts peak). It uses switchable Spatializer 3-D enhancement circuitry. Each unit has a 5/8-inch dome tweeter and a 3-inch woofer. On our tests, we found a very grainy quality in the pink noise, suggestive of frequency-response irregularities. The low end of orchestral selections was fine, but the high notes tended to screech. The treble control was only moderately successful in taming the high end and could not eliminate a harshness on orchestral string attacks. The 3-D circuitry did nothing for the orchestral music except harshen its sound. On the jazz test, the intimate setting of "Jazz in the Pawnshop" came through well, but the tone was somewhat hard on vibes. The sax sounded a bit like a clarinet. We recommend leaving the 3-D enhancement off, even on jazz. \$99 list; Labtec Enterprises, 360-896-2000, www.labtec.com.

Multimedia Labs TC-1525 Mach II

The Multimedia Labs TC-1525 Mach II is a five-piece set: a pair of two-speaker, sloped-panel desk units; an amplifier and control unit with Spatializer circuitry; a desktop amplifier with volume display; separate bass and treble controls; a stepped volume control, balance control, and microphone volume control; a large under-desk subwoofer with its own amplifier; and a hand-held remote-control unit that handles power, volume, and muting for the whole system. The amplifier is rated at 25 watts for the

desktop units and another 25 for the subwoofer. The TC-1525 produced a soundstage with good depth on our jazz test, though relatively poor width. Without the Spatializer, the instruments (especially saxophones) seemed to have an "in your face" feel. The 3-D en-



hancement certainly produced an aura on the soundstage but eliminated instrumental placement. Vibes sounded good, but the piano sounded as if it were being played with the lid down. On the classical-music test, the violins seemed steely without 3-D enhancement. The Spatializer masked this somewhat, but not completely, and made the orchestra sound as if it were playing in an echo chamber. Overall, the TC-1525 Mach II had a hard sound, suggesting an uneven frequency response. \$229 list; Multimedia Labs Inc., 410-429-4300.

Roland MA-8

At \$99, the Roland MA-8 was our choice for best bargain (the Soundworks is much more expensive). Its two 8-watt satellites tie up a lot of desktop real estate, but the sound quality is well worth the sacrifice. The MA-8 soundstage was excellent both in width and in depth. The reproduction of our pink-noise test signal was not entirely smooth, and this showed up in a slight hardness in the sound of the orchestral strings. The MA-8 produced excellent piano clarity and brightness, however, along with fine jazz vibes and

sax. It could handle hard high notes without any audible distortion. \$99 list; Roland Corp. U.S., 213-685-5141, www.rolandus.com.

Sony SRS-PC51

Evaluating the Sony SRS-PC51 was not an entirely pleasant task. Its two ear-shaped speakers use severely dysfunctional mounting hardware that provides minimal stability, and the set's volume and treble controls turn backward. The piano tone was fair, but the orchestra sounded brittle and unmusical. We couldn't pinpoint any instruments in the tiny soundstage at all; they all seemed to come en masse from the monitor. Some distortion was also apparent in the loud passages, thanks to overloading of the tiny 2.5-watt amplifiers. The sound was slightly better on our jazz selection, but even with the speakers physically spread out, the sound field had little width and depth. In sum, the SRS-PC51 sounded like a cheap Walkman. \$89.95 list; Sony Electronics Inc., 800-222-7669, www.sony.com.

Yamaha YST-M15

The Yamaha YST-M15 is a two-piece system with a single, full-range 10-watt speaker in each unit. In addition to a volume control, it has a balance adjustment and a single, somewhat ineffective tone control. It produced a soundstage of medium depth and width, and a very clear piano tone with each note in a run sharp and distinct. Massed orchestral strings were a bit thin on top, however. The YST-M15 produced a very good room rendition in "Jazz in the Pawnshop," with excellent snare drums and vibes and a very smooth sax. \$89 list; Yamaha Electronics Corp., 800-823-6414, www.yamaha.com.—*Craig L. Stark*

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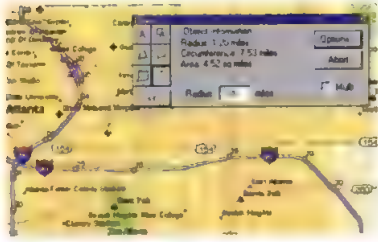
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[*DICTIONARY OF THE FUTURE, PAGE 531*]

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After Hours

THE BEST OF AFTER HOURS

Here are our picks for the best entertainment and educational software from 1996.

Command & Conquer was one of the primary reasons real-time strategy games have become so popular. \$60 street; Virgin Interactive Entertainment, 800-874-4607, www.vie.com. (Reviewed: January 9, 1996, page 390.)

Critical Mass: America's Race to Build the Atomic Bomb, a documentary title, achieved a level of quality we wish we saw more often. \$55 street; Corbis Corp., 800-246-2065, www.corbis.com. (Reviewed: March 26, 1996, page 315.)

Disney's Animated Storybook, Toy Story was Disney's

best software effort yet (and the most bug-free). \$35 street; Disney, 800-900-9234, www.disney.com/ToyStoryBook. (Reviewed: September 10, 1996, page 437.)

Duke Nukem 3D, though violent and offensive to many, was one of the year's best action games. \$39.95 list, 3D Realms Entertainment, 800-276-4331, www.3drealms.com. (Reviewed: July 1996, page 452.)

Freddi Fish 2: The Case of the Haunted Schoolhouse is the latest hit kids' game from Humongous Entertainment. \$39.95 list; Humongous Enter-



tainment, 800-499-8386, www.humongous.com. (Reviewed: November 5, 1996.)

On the Road With B.B. King tells the tale of the king of the blues with wonderful art and music. \$39.95 list; MCA Records, 818-777-4000, bbking.mca.com. (Reviewed: April 9, 1996, page 383.)

Quake is simply the standard by which future action games will be judged. \$45 direct; id Software, 800-434-3627, www.idsoftware.com. (Reviewed:

October 8, 1996, page 455.)

Sesame Street: Get Set to Learn! is a fun and funny learning game filled with familiar characters. \$39.95 list; Creative Wonders, 800-543-9778, www.cwonders.com. (Reviewed: August 1996, page 483.)

Warcraft II: The Tides of Darkness, another real-time strategy game, earned classic status virtually overnight. \$50 street; Blizzard Entertainment, 800-953-7669, www.blizzard.com. (Reviewed: April 9, 1996, page 375.)

Wing Commander IV: The Price of Freedom is a space-combat epic that embodies the term *state of the art*. \$55 street; Origin Systems, 800-245-4525, www.ea.com/origin.html. (Reviewed: May 14, 1996, page 357.)—MER

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DVD and CD-ROM

The next optical-storage paradigm is upon us. DVD disks can hold 4.7GB and promise to deliver full-motion video, surround-sound audio, and tons of data. We tell you what to expect from the new technology and also put the present crop of 10X and 12X CD-ROM drives to the test.

Personal Finance Software

Just in time to help you follow through on your New Year's resolutions, we look at four Windows-based personal finance software packages that can help you get your monetary matters in order. This year's crop includes more electronic banking options along with better, more focused online links.



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NE—Network Edition.

For information about the Network Edition of *PC Magazine*, call Circulation at 800-289-0429.

Abort, Retry, Fail?

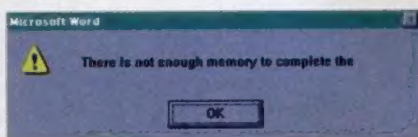
THE LIGHTER SIDE OF PERSONAL COMPUTING

By Don Willmott

Every Visitor to France Has Experienced This Attitude

"Please find herewith an evaluation copy of the software I've developed: Mediathek '97. The program runs under Windows 95 and uses a setup program called Install Wizard. Install Wizard is in French but there should be not [sic] problems since it uses the same look and feel as any other installer."—MEDIATHEK SOFTWARE LETTER

The—um—
the—um, um,
um....
(Microsoft Word
for Windows.)



ARF on the Road:
Chambersburg,
Pennsylvania. (Don't
get melted butter on
the keyboard!)

Ask a Stupid Question. . .

At a recent Microsoft event held at company headquarters, CEO Bill Gates was asked whether he had doubts about any aspect of The Microsoft Network's new Web-based online service. "Doubts? Doubts?" he replied. "Well, we're not going to make any money on it for a while. I have no doubt about that."

If your entry is used, we'll send you \$50 and a PC Magazine T-shirt. Send your entries to Abort, Retry, Fail?, PC Magazine, One Park Ave., New York, NY 10016-5802 or, via e-mail (text items only), to don_willmott@zd.com. Winners this issue: Samuel Hozman, Mark Rosen, and Warren Sklar.



In Ocean City, cyberspace looks a heck of a lot like Lotus 1-2-3, circa 1982. (Ocean City, Maryland Chamber of Commerce ad.)

Well, We're Always Looking For New Ideas

"Poser is an exceptionally powerful reference tool and the first program to release your creative energy on the human body."—PC MALL AD



"I don't know how it happened, but there's an applet in the toaster and some guy in Norway keeps burning my toast."

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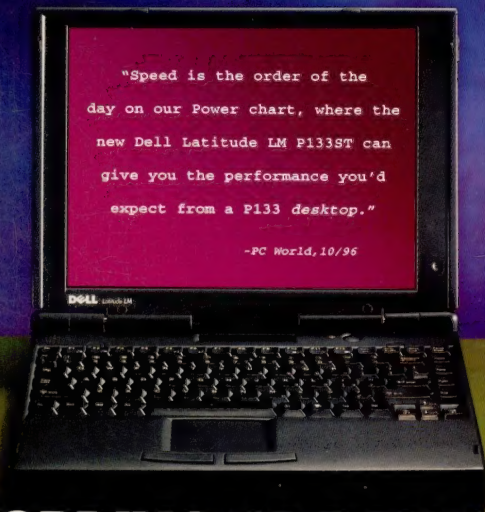
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We could go on and on. They certainly did. But we'll let you get to a phone first.

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